THE IMPACT OF WATER POLLUTION ON ECONOMIC DEVEPLOPMENT AND SOCIAL WELL-BEING OF TURAG RIVER

BY

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This Thesis Report Presented in Partial Fulfilment of the Requirement for the Degree of Bachelor of Science (B.Sc.) in Environmental Science and Disaster Management (ESDM)

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APPROVAL

This thesis report titled *"The Impact of Water Pollution on Economic Development and Social Well-being of Turag River"* submitted by Nadima Tasnim to the Department of Environmental Science and Disaster Management (ESDM), Daffodil International University (DIU), has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Bachelor of Science (B.Sc.) in Environmental Science and Disaster Management (ESDM) and approved as to its style and contents. The presentation has been held on 15th March 2024.

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DECLARATION

I hereby declare that this research project has been done by me under the supervision of **Dr. Mahfuza Parveen, Associate Professor, Department of Environmental Science and Disaster Management (ESDM),** Daffodil International University (DIU). I also declare that neither this research project nor any part of this research project has been submitted elsewhere for the award of any degree.

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DEDICATION

To,

my loving parents

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Nasrin Sultana

my Younger Brother

Rahat Mashrafi

my respected teachers

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someone special of mine

Md Salim Mahmud

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ABSTRACT

Rapid urbanization and economic progress throughout Asia have the unintended consequence of causing river pollution through the release of untreated sewage and industrial effluent. We developed a direct observation method to document people's everyday activities along rivers during both dry and rainy seasons. This method supplemented by monthly monitoring of river water quality, heavy metal and biotoxicity evaluation and other data to better understand the socio-spatial and seasonal inequalities in pollution risks. A comprehensive survey conducted in Dhaka, Bangladesh, along a 25 kilometer stretch of the Turag River. Heavy metals from the yearly Bishwa Ijtema gathering and downstream industrial zones further aggravated and nearly nonexistent dissolved oxygen levels that we discovered during the low flow season. Throughout the year, there was a constant risk of pollution exposure from household activities, especially for women and girls living in low-income areas without proper access to water and sanitation. Men and children were most likely to swim during the monsoon, which increased their chance of contracting infections. An understanding of the socio-economic disparities at risk can help with the planning and implementation of policy that combines long-term mitigation with short- term adaptation.

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CHAPTER 1: INTRODUCTION

1.1. Background and Context

The Turag River, flowing through the core of Bangladesh, serves as more than just a watercourse; it is a vital artery, providing nourishment and embodying cultural legacy. However, it has experienced considerable environmental strain in recent years as a result of human activities. The river, a vital asset for nearby communities, has been afflicted by pollution stemming from several origins, such as industrial discharges, improper waste management, and agricultural runoff.

Turag River is experiencing a notable issue with heavy metal pollution. Research has shown that the river sediments include elements like chromium (Cr), lead (Pb), cadmium (Cd), nickel (Ni), zinc (Zn), copper (Cu), iron (Fe), and manganese (Mn) (Baki et al., 2020; A. Rahman et al., 2021). The levels of these metals frequently surpass both local and international safety thresholds, indicating a significant degree of contamination. For example, the concentrations of Cr, Zn, and Ni have been discovered to be nearly double the amounts typically seen in the environment, while Cd is around three times higher (A. Rahman et al., 2021). The existence of these metals in the sediments of the river indicates a gradual buildup over time, which poses a threat to the overall biological balance of the river and the well-being of aquatic creatures.

The water quality of the Turag River has been negatively affected, as indicated by studies that have observed alterations in physicochemical parameters like pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), and biological oxygen demand (BOD) (Banu et al., 2013; Halder et al., 2015; M. A. T. M. T. Rahman et al., 2013). The water downstream has been discovered to be heavily contaminated and unfit for both human consumption and aquaculture activities (Halder et al., 2015). Fluctuations in water quality based on the seasons have been noted, with the most elevated levels of pollutants being detected during the winter (M. A. T. M. T. Rahman et al., 2013).

The pollution of the Turag River has had direct consequences on human health, with local communities suffering from diseases such as allergies, skin infections, respiratory problems, and gastrointestinal illnesses (J. Islam et al., 2018; Prodhan et al., 2022). The ingestion of fish sourced from the river is also a matter of health concern, since there has been a buildup of heavy metals in the internal organs of commonly consumed fish species, beyond the maximum allowable thresholds established by health organizations (Mohiuddin et al., 2016). The pollution of the Turag River is caused by a variety of factors, including industrial waste, sewage from cities, solid waste, pesticides used in agriculture, and other human activities. These factors are all contributing to the decline in water quality (J. Islam et al., 2018). The absence of environmental flow in the river, which is crucial for preserving its ecological well-being, has been worsened by decreased flow rates and the failure to reach mandated environmental flow levels during periods of low flow (M. Islam et al., 2013).

In conclusion, the Turag River is currently experiencing a severe pollution crisis that poses a significant threat to its ecological equilibrium and the welfare of the communities that rely on it. To limit the negative impacts and return the river to a healthier condition, it is crucial to engage in prompt and ongoing monitoring, pollution prevention, and cleanup efforts. Enforcing stringent measures to regulate the emission of pollutants and guaranteeing adherence to environmental flow standards are crucial for the sustainable administration of the Turag River.

1.2.   Problem Statement

Water pollution in the Turag River has been a growing concern, with potential repercussions on the local economy and the social well-being of the communities residing nearby. The degradation of water quality not only poses health risks but also threatens the livelihoods of individuals dependent on river-based activities. Understanding the multifaceted impact of water pollution is crucial for devising sustainable development strategies to mitigate the adverse effects and enhance the living conditions of the local populace.

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1.3. Study Objective

a) To investigate the extent to which water pollution in the Turag River affects local economic activities such as fishing, agriculture, and tourism.

b) To explore the impact of water pollution on the social well-being and health of the communities living along the Turag River.

1.4. Significance of the Study

The Turag River holds significant importance for us. Countless individuals' lives are intertwined with it, including both existence and sustenance. Individuals utilizing the water from the Turag river are susceptible to several illnesses. Given its strategic location, doing a thorough investigation of its influence is crucial. Furthermore, it is crucial to analyze its correlation with fishing, agriculture, or industry. By accurately identifying all of these issues, it will become feasible to resolve them effortlessly. If we are able to address the diverse issues associated with this river, it has the potential to serve as a viable alternative for promoting tourism. Overall, this crucial resource holds significant value for us, and its ongoing contamination is resulting in harm to both the general population and the nation in multiple ways. If promptly discovered and remedied, this situation has the potential to yield economic benefits and alleviate issues faced by the general public. Hence, it is crucial to thoroughly examine this matter.

1.5. Study question

a) What is the extent to which water pollution in the Turag River affects local economic activities such as fishing, agriculture, and tourism?

b) What is the impact of water pollution on the social well-being and health of the communities living along the Turag River?

CHAPTER 2: LITERATURE REVIEW

The Turag River in Bangladesh is heavily polluted, primarily due to industrial effluents and sewage outfalls (Prodhan et al., 2022). This pollution has led to a range of negative consequences, including health issues, reduced agricultural production, and changes in occupational status (Prodhan et al., 2022). The main pollutant in the river is total suspended particulates, with industrialization, overpopulation, and land use changes being key drivers of this pollution (Eziz et al., 2008). The water quality of the river is not suitable for domestic use, and the surrounding communities suffer from a variety of health problems (Halder et al., 2015). These issues have significant implications for the economic development and social well-being of the area, highlighting the urgent need for pollution reduction efforts.

2.1 Water Pollution and Environmental Degradation

Water pollution and environmental deterioration are prominent concerns, especially in metropolitan regions. (Zhu et al., 2002) and (Ferreira et al., 2018) emphasize the impact of human activities, such as home sewage and urban growth, on the emergence of these issues. (Owa, 2013) highlights the imperative of implementing efficient measures to regulate and oversee water contamination, which includes the implementation of environmental education. (Falkenmark, 2005) emphasizes the gravity of the problem, especially in countries undergoing industrialization and development, and the possibility of significant health consequences in the future.

2.1.1. Industrial Discharge

Industrial effluents have been identified as a significant contributor to the pollution burden of the Turag River (Hafizur et al., 2017; Prodhan et al., 2022). These effluents, along with municipal and illegal residential sewage outfalls, have been found to release directly into the river, leading to a range of environmental and health consequences (Prodhan et al., 2022). The presence of various pollutants, including heavy metals, in the river water has been attributed to these sources (Hafizur et al., 2017). To address this issue, it has been recommended to reduce the concentration of contaminants and to

implement measures such as the establishment of effluent treatment plants (Rabbani, 2017).

The Turag River in Bangladesh is facing significant pollution from industrial effluents, with high levels of heavy metals such as Pb, Cd, Zn, Cu, and Cr posing a serious risk to aquatic life and ecosystem health (Banu et al., 2013; Hafizur et al., 2017). These contaminants have been found to exceed sediment quality guidelines, leading to a high ecological risk (Ezekwe & Utong, 2017). The situation is further exacerbated by the seasonal variation in pollution levels, with higher contamination loads during the dry season (Hafizur et al., 2017). The need for routine monitoring and regulatory standards to address this issue is emphasized (Arisekar et al., 2020).

2.1.2. Agricultural Runoff

Agricultural activities, particularly the use of fertilizers and pesticides, have been identified as significant contributors to nutrient runoff and sedimentation in the Turag River (Bainbridge et al., 2009; Prodhan et al., 2022; Uwimana et al., 2018). These pollutants, along with industrial effluents and sewage, have led to the pollution of the river, impacting both the environment and the health of local communities (Prodhan et al., 2022). The impact of land use on river nutrient concentrations has been highlighted, with impervious surfaces, a proxy for urban activities, identified as a key driver of nutrient concentrations (Xia et al., 2016). The need for appropriate land management practices, such as minimal tillage and vegetation buffer zones, to intercept pollutants in runoff has been emphasized (Uwimana et al., 2018).

Excessive nutrient loading, particularly potassium and phosphate ions, has been identified as a major contributor to the pollution of the Turag river in Bangladesh (J. Islam et al., 2018). This has led to the depletion of oxygen levels and the disruption of the river's ecological balance (Whitehead et al., 2018). The increase in dissolved inorganic nutrients, particularly nitrogen and phosphorus, has been linked to the occurrence of harmful algal blooms in other water bodies (Li et al., 2014). These blooms can further exacerbate the depletion of oxygen levels and the disruption of the ecological balance. Therefore, it is crucial to address the issue of excessive nutrient loading in the Turag river to restore its water quality and ecological balance.

2.1.3. Urbanization

Rapid urbanization along the banks of the Turag River has significantly increased pollution from domestic sewage, solid waste, and urban runoff (Prodhan et al., 2022; Rabbani, 2017). This pollution is primarily caused by industrial effluents, municipal and illegal residential sewage outfalls, and various other human activities (Prodhan et al., 2022). The consequences of this pollution include dark-colored and foul-smelling water, health issues for local residents, and negative impacts on aquatic life, agriculture, and livelihoods (Prodhan et al., 2022). The river's water quality has been severely degraded, with high levels of contaminants such as chromium and nickel (Sadiqa et al., 2021). To address these issues, it is crucial to implement existing laws and regulations, remove illegal buildings from the riverbank, and establish effluent treatment plants (Rabbani, 2017).

The pollution burden and compromised water quality in the Turag River in Bangladesh have been exacerbated by insufficient sanitary infrastructure and inadequate waste management (Majed & Islam, 2022; Mukar et al., 2022; Tasnim Mukarram et al., 2023). The Turag River is subject to significant pollution caused by human activities, specifically from industrial, municipal, and home sources (M. Rahman, 2022). The river exhibits severe pollution, as evidenced by considerable deviations of water quality measures such as suspended solids, biochemical oxygen demand, and ammoniacal nitrogen from industrial discharge standards (Chowdhury et al., 2022). The pollution indices, such as the comprehensive pollution index and organic pollution index, provide additional evidence of the elevated pollution levels in the Turag River.

The presence of pollution and the low quality of water have adverse effects on the ecosystem services offered by the river and also pose hazards to human health. To enhance water quality and safeguard the ecosystem services of the Turag River, it is imperative to tackle the insufficient sanitation infrastructure and establish efficient waste management strategies.

2.2. Economic Implications

The Turag river water pollution has a substantial economic impact. The pollution is a result of the release of industrial effluents, municipal and household waste, and other

human activities (R. Kabir & Khan, 2016; Sadiqa et al., 2021). The pollution has caused a decline in the quality of water and soil, leading to adverse impacts on rice production (Prodhan et al., 2022). The prevalence of insect infestation has escalated, resulting in a decline in agricultural productivity (Afrad et al., 2020). The contaminated water is unsuitable for human consumption, hence impacting the health of the local populace (M. Rahman, 2022). The pollution has also had a detrimental effect on aquatic life, fisheries, and cattle, hence exacerbating the impact on the livelihoods of the riverine inhabitants. The presence of industries in the area has adversely impacted the quality of soil, water, and rice cultivation. Efforts should be undertaken to reduce the level of pollutants and provide effective treatment methods for industrial waste in order to alleviate the economic consequences of water pollution in the Turag river.

2.2.1. Agricultural Productivity

The Turag River in Bangladesh is a vital watercourse that has been greatly affected by pollution, leading to substantial consequences for agricultural output and public well-being. This synthesis investigates the magnitude of pollution and its repercussions, drawing on recent research findings. The sediments of the Turag River contain significant amounts of heavy metals, including Cr, Pb, Cd, Ni, Zn, Cu, Fe, and Mn. The concentrations of these metals are so high that they exceed the reference limits for severe effects and toxicity, indicating a serious contamination (Hoque et al., 2021). There are noticeable fluctuations in the use of rivers and exposure to pollution based on the seasons. Dry seasons are characterised by elevated levels of ammonia and reduced levels of dissolved oxygen. Conversely, during monsoon seasons, there is an increased likelihood of coming into contact with contaminated water. This is particularly true for women, girls, and low-income populations (Mohiuddin et al., 2016).

The contamination of the Turag River has led to various adverse effects on the local population, such as health problems, harm to aquatic organisms, decreased agricultural output, and alterations in occupational practices. Industrial waste and sewage have been recognized as the primary sources of this pollution (Rabbani, 2017). The utilization of contaminated river water for irrigation has resulted in the buildup of hazardous metals in both soil and crops, namely rice. This situation presents enduring health hazards and

amplifies the likelihood of developing cancer during one's lifetime for consumers, as a consequence of heightened levels of Arsenic (As) and Lead (Pb) (Prodhan et al., 2022).

2.2.2. Tourism Revenue

The degradation of water quality in the Turag River is a significant concern, with studies identifying various sources of pollution, including industrial effluents, domestic sewage, and textile waste (Rabbani, 2017; M. Rahman, 2022; Sadiqa et al., 2021). These pollutants have led to a decline in water quality parameters, such as dissolved oxygen, chemical oxygen demand, and total dissolved solids, as well as an increase in heavy metal concentrations (Sadiqa et al., 2021). The impact of this pollution on the river's aquatic ecosystem and biodiversity is a key area for further research (M. Rahman, 2022). The potential for tourism development in the area is also threatened by this pollution, as seen in the case of Lijiang Ancient Town (Baoying & Yuanqing, 2007). Therefore, urgent action is needed to address the pollution sources and improve the water quality of the Turag River.

2.3. Social Well-being and Public Health

The contamination of the Turag River has substantial repercussions for societal welfare and the health of the general populace. The river is polluted by industrial effluents, municipal and residential sewage, waste, pesticides, and several other human activities (Prodhan et al., 2022). The pollution has resulted in the water becoming black and emitting an unpleasant smell. This has led to many health issues among the local population, including allergies, skin infections, and respiratory problems. Additionally, the pollution has had detrimental effects on aquatic life, fisheries, cattle, and agricultural production (Sadiqa et al., 2021).

2.3.1. Waterborne Diseases

Vulnerable populations, particularly children and the elderly, are at a higher risk of waterborne illnesses due to factors such as decreased immunity and age-related changes in the gastrointestinal tract (Gerba et al., 1996; Smith, 1998). In less developed countries, children under 5 are particularly affected by waterborne diseases due to poor sanitation and hygiene practices (Manetu & Karanja, 2021). The severity of these illnesses is also higher in these populations, with the elderly being more likely to die from foodborne infections (Smith, 1998) and the very young, elderly, and

immunocompromised being at the greatest risk of severe illness and mortality from waterborne pathogens (Gerba et al., 1996).

The water quality in the Turag River is characterized by inadequate quantities of dissolved oxygen and excessive turbidity, rendering it unsuitable for human consumption (A. Kabir et al., 2022). Human activities, such as channel modification and encroachment, impair the river habitat (Hoque et al., 2021). There is an unequal distribution of pollution hazards, with women and girls in low-income settlements being more exposed to pollution through household activities, and males and children being at risk of pathogen contamination during the monsoon season (Kant Pareek et al., 2020). The contaminated water of the Turag River is linked to the transmission of waterborne illnesses such as jaundice, diarrhoea, typhoid, hepatitis, and malaria.

2.3.2. Access to clean water

Water pollution, caused by a variety of factors including industrial waste and poor sanitation, has a significant impact on public health, particularly in low-income communities (Bartram & Cairncross, 2010; Eneh & Eneh, 2014; Kumar Karn & Harada, 2002; Pandey, 2006). This pollution restricts access to clean water for drinking, sanitation, and hygiene, perpetuating a cycle of poverty and ill health (Eneh & Eneh, 2014; Kumar Karn & Harada, 2002; Pandey, 2006). The situation is particularly dire in Africa, where corruption and poor governance exacerbate the problem (Eneh & Eneh, 2014). The burden of water-related diseases, such as diarrhea and typhoid, is disproportionately high in these communities (Kumar Karn & Harada, 2002). Therefore, addressing water pollution is crucial for improving public health and breaking the cycle of poverty.

2.4. Policy Interventions and Remedial Measures

2.4.1. Regulatory Frameworks

A comprehensive policy framework is crucial for addressing the pollution of the Turag River, as identified by (Rabbani, 2017). This framework should encompass industrial discharge, agricultural practices, and urban development activities, as suggested by (Dong et al., 2022; Ning et al., 2020). The framework should also consider the interactive effects of point and non-point sources of water pollutants, as highlighted by

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(Muyibi et al., 2008). It should include measures such as the implementation of existing laws and regulations, the establishment of effluent treatment plants, and the use of low-impact development facilities to control non-point source pollution. Furthermore, it should focus on the restoration of river ecosystems and the sustainable management of river sources.

2.4.2. Technological Innovations

Investment in research and development of eco-friendly technologies is crucial for the remediation of polluted water bodies and enhancement of wastewater treatment efficiency (Dixit et al., 2011; Guo et al., 2019; Ncibi et al., 2017; Simon & Joshi, 2021). Biomass-based technologies, including bio-adsorption, phytoremediation, and microbial remediation, have been identified as effective and sustainable methods for removing emerging pollutants from contaminated wastewaters and aquatic environments (Ncibi et al., 2017). Green technologies, particularly integrated eco-technologies, have shown promise in rejuvenating polluted surface water bodies, with a focus on real-world application and performance (Simon & Joshi, 2021). The integration of green energy and advanced energy-efficient technologies in municipal wastewater treatment plants has the potential to reduce energy consumption and enhance overall efficiency (Guo et al., 2019). Additionally, the use of terrestrial and aquatic plants in wastewater purification has been highlighted as a low-cost and eco-friendly approach (Dixit et al., 2011). These studies collectively underscore the importance of investing in eco-friendly technologies to address water pollution and improve wastewater treatment.

2.4.3. Community Engagement

Community participation and stakeholder engagement are crucial for successful environmental conservation efforts and reducing water pollution (Dyer et al., 2014; Eaton et al., 2021; Shandas & Messer, 2008; Wagenet & Pfeffer, 2007). These efforts can be enhanced by flexible, community-initiated projects that foster local ownership and trust in government (Shandas & Messer, 2008). Meaningful community engagement is key, requiring open definition of 'community', two-way communication, and charismatic leadership (Dyer et al., 2014). A conceptual framework for social, behavioral, and environmental change through stakeholder engagement in water

resource management can guide these efforts (Eaton et al., 2021). The U.S. EPA framework for civic engagement in water resource management is also a valuable tool, emphasizing the importance of financial resources and a strong commitment to civic engagement (Wagenet & Pfeffer, 2007).

After doing a thorough analysis of different research papers, we have assessed the importance of Turag for our specific objectives. Therefore, it is crucial to analyses the consequences of water contamination in the Turag River on local economic sectors such as fishing, agriculture, and tourism, as well as investigate the effects of water pollution on the social well-being and health of the populations residing along the banks of the Turag River.

CHAPTER 3: METHODOLOGY

3.1. Research Design

The primary aim of this study is to assess the extent of water contamination in the Turag River and examine its associated impacts. Examine the specific economic ramifications and the disturbance to the daily lives of individuals. The research utilized both quantitative and qualitative methodologies to provide precise and reliable conclusions (Bryman, 2003). A comprehensive needs assessment was undertaken by analyzing both quantitative and qualitative data in order to gain a more profound understanding.

3.2. Data Collection Method

3.2.1. Study Area

To obtain comprehensive insights into the daily lives of individuals residing near the Turag River, data was gathered from the general populace. The primary objective was to establish a profound understanding of their routine activities and ascertain the correlation between their lifestyles and the river. Furthermore, in order to have a comprehensive understanding of the pollution levels in the Turag river, data has been gathered from experts for more studies. Data was additionally gathered from industries located in the vicinity of the Turag River to examine the correlation between industrial activities and the pollution levels in the river.

3.2.2. Sample Size

Since this study incorporates both qualitative and quantitative methodologies, it will collect data from both categories. The sample size was found using the formula $n = z^2pq/d^2$, where n represents the sample size, z is the z-score, p and q are the probabilities of success and failure respectively, and d is the desired margin of error. Let n be the sample size, z be the value of 1.96 for a 95% confidence interval, p be the prevalence of individuals affiliated with this (which is 0.50), q be the complement of p, and d be the desired margin of error (which is 5% or 0.05). The value of n is determined by the following calculation: The value of n is calculated by squaring 1.96 and multiplying it by 0.50 and 0.50, then dividing the result by 0.05. The square of a number is equal to 384. The sample size was determined using an appropriate statistical method to get the

minimum sample size for descriptive studies (Lwanga et al., 1991). It was assumed that the prevalence of beneficiaries in Bangladesh is 50% due to a lack of relevant data. The minimum sample size required is 384, as calculated. The table presents a succinct summary of the participants, sample size, and methodologies.

Data Collection Techniques	Respondents	Sample Size
Key Informant Interview (KII)	Professionals A) Government officials - 3 B) Environmental experts- 3 C) NGO representatives – 2 D) Industry representatives – 3 E) Community Leaders and Stakeholders - 2	13
Survey	a) Households b) Farmers c) Industrial workers d) Tourism operators	120+100 100+64=384
	Total Respondents	397

Table 1: Methods, Respondents, and Sample Size

3.2.3. Period of Data Collection

The data collection methodology for this study comprised a sequence of consecutive stages. A comprehensive data collection was conducted in October and November. The data collection methods employed included extracting insights from key informants and administering a survey to obtain information.

3.2.4. Modality of Data Collection Instruments

In order to obtain a comprehensive understanding of this study, two methods of data collecting were utilized: a structured questionnaire survey and Key Informant Interviews (KII).

3.2.5. Structured Questionnaire

An important use of planned interview schedules during fieldwork is to verify the data collected from key informants and in-depth interviews. A total of 384 structured questionnaire surveys were scheduled to be conducted with persons who possess a comprehensive

3.2.6. Key Informant Interviews (KII)

Typically, those chosen as key informants are those believed to possess exceptional expertise in the given field. Acquiring the requisite data necessitates relying on the most dependable sources of information. A proposal was made to perform a total of 13 Key Informant Interviews (KII) with individuals A, B, C, D, etc. For the purpose of sampling a population, ten qualitative sample sizes can be adequate (Sandelowski, 1995).

3.3. Sampling Strategy

3.3.1. Sampling Technique

To achieve a thorough comprehension of this study, two data collection approaches were utilized: a structured questionnaire survey and Key Informant Interviews (KII). A stratified random sampling approach was employed to obtain the desired sample for KIIs. A random sampling approach was employed to obtain the appropriate sample of survey participants.

3.3.2. Analytical Technique

After gathering all pertinent information, the data underwent meticulous validation and cross-verification. Afterwards, every questionnaire was encoded and inputted into the SPSS/STATA database. Following a thorough evaluation of the Key Informant Interviews (KIIs), the data was meticulously reviewed, modified, and converted into written form. The qualitative analysis entailed doing data computations utilizing the anthropic sub-program, adhering to a certain category and categorization framework.

3.4. Ethical Consideration

Ethical clearance will be obtained from the appropriate authority and informed consent will be obtained prior to the interview. Appropriate measures will be taken to obtain consent for interview recording, data presentation, and information sharing. The

participant will remain anonymous throughout the interview and will be considered an integral part of the study.

CHAPTER 4: RESULT AND DISCUSSION

The Turag River, previously essential for the nearby communities, is now a source of increasing worry because of its rising pollution levels. The decline in water quality not only endangers the river's ecosystem but also presents substantial risks to economic growth and the social welfare of the local community. The economic consequences are significant, as most participants in recent studies have pointed out the negative effects on local businesses. This concern is shared by 94.8% of respondents who feel that pollution is impacting economic activities. These businesses, which heavily depend on the river for water, transportation, and resources, are now facing the immediate impacts of environmental neglect.

In terms of social impact, many community members have reported health issues they attribute to the contamination of the river. Approximately 76.3% of participants have faced health problems, highlighting the serious impact pollution has on public health. The community's view of the quality of life in areas impacted by the Turag River's pollution is highlighted by 25.8% reporting a decrease, emphasizing the social challenges linked to environmental harm. Despite the challenges, there is a clear consensus on the urgency of addressing the river's pollution, with 87% considering it 'Very Important.

Table 2. Participants State

Age Group	Total	Frequency	Percent	Valid Percent	Cumulative Percent	Gender	Frequency	Percent	Valid Percent	Cumulative Percent
18-25		56	19.4%	20.1%	20.1%	Male	186	64.6%	65.5%	65.5%
26-35		106	36.8%	38.0%	58.1%	Female	98	34.0%	34.5%	100.0%
36-45		48	16.7%	17.2%	75.3%					
46-55		38	13.2%	13.6%	88.9%					
56 above		31	10.8%	11.1%	100.0%					
Total	288	279	96.9%	100.0%		Total	284	98.6%	100.0%	
Missing		9	3.1%			Missing	4	1.4%		

This overwhelming concern reflects not only individual hardships but also a collective apprehension about the future of their community and its environmental heritage. The pollution of the Turag River goes beyond being an ecological crisis; it significantly hinders the sustainable development of the area and the well-being of its residents. Considering these discoveries, the thesis "The Effects of Water Pollution on Turag River's Economic Development and Social Well-being" delves into the various impacts of water pollution, emphasizing the need for a prompt and cooperative effort to revive the river and protect the community's future.

4.1. Data Analysis

The data shows a higher number of younger participants, specifically in the 26 to 35 age range, with more males than females included in the study. The data shows the demographic breakdown of the study's participants, with a noticeable preference for younger individuals and a higher number of male respondents among the valid answers. Adding the missing data points indicates some non-response or data collection problems that affect only a small portion of the entire data set.

Altogether, 288 individuals took part in the study. Out of the 279 participants whose ages were recorded, the age group of 26-35 years had the highest representation at 38.0% of valid age responses. This was followed by the 18-25 age group at 20.1%, the 36-45 age group at 17.2%, the 46-55 age group at 13.6%, and lastly, the 56 and above age group at 11.1%. Out of the total participants, 9 responses were missing regarding age, which accounted for 3.1%

This table combines the age and gender data into one view. To make it clearer, the gender data is included on the right side, showing the total distribution of male and female participants separately from the age data. This structure enables a straightforward comparison among different age groups and genders within the study's participants. It's crucial to understand that the 'Total Participants' column represents the total count for each subgroup (age and gender). The columns show the frequency and cumulative percent for each category, displaying both the raw counts and their proportional representation in the study.

When it comes to gender, data was collected from 284 participants. Of these, 186 identified as male, making up 65.5% of the valid gender responses, while 98 identified as female, accounting for 34.5%. Four responses were missing for gender, accounting for 1.4% of all participants.
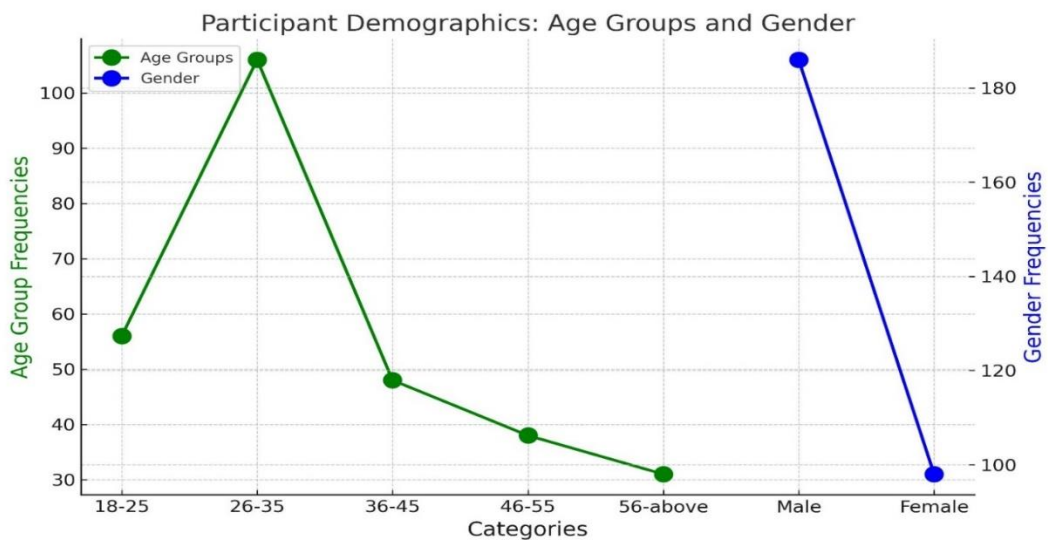
Figure 1.   Participant Demographics: Age, Groups and Gender

The graph shows a significant majority of individuals in the 26-35 age bracket, suggesting a high presence of young adults in the research. The age distribution demonstrates a gradual decline in frequency as age increases beyond 35 years, with the smallest number of participants found in the 56 and above age group. When it comes to gender distribution, there are more males than females in the participant pool, making up about two-thirds of the total. This disparity in gender representation points to a possible area for future research or exploration to achieve a more equitable balance. Overall, the graph offers a brief visual overview of the demographic composition of the study's participants, highlighting the importance of including a variety of ages and genders in research.

Education level of Participant					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary School	61	21.2	21.9	21.9
	Secondery School	102	35.4	36.7	58.6
	College	45	15.6	16.2	74.8
	University	37	12.8	13.3	88.1
	Others	33	11.5	11.9	100.0
	Total	278	96.5	100.0	
Missing	System	10	3.5		
Total		288	100.0		

Table 3. Education Level of Participant

This table details the education levels of participants in a study, offering insights into their academic backgrounds. The data reveals a wide range of educational achievements among the 288 participants, with 278 valid responses and 10 missing or unrecorded entries, making up 3.5% of the total.

The highest number of participants have completed secondary school education, with 102 individuals representing 36.7% of valid responses, showing that most participants have finished high school. Next comes primary school education, with 61 participants (21.9%), indicating that a considerable number of the sample have education up to the elementary level.

Out of the total valid responses, 45 participants have a college education (16.2%), while 37 have a university degree (13.3%), indicating a smaller percentage of the sample with higher education. Furthermore, 33 participants (11.9%) are categorized as "Others," which may include vocational training, no formal education, or non-traditional educational paths, showcasing the variety of educational backgrounds.

The cumulative percentages show a clear progression of educational attainment levels among the participants, from primary education to university and beyond. The distribution highlights the significance of taking into account educational background when analyzing the data and indicates a range of access to or completion of formal education among the study's participants.

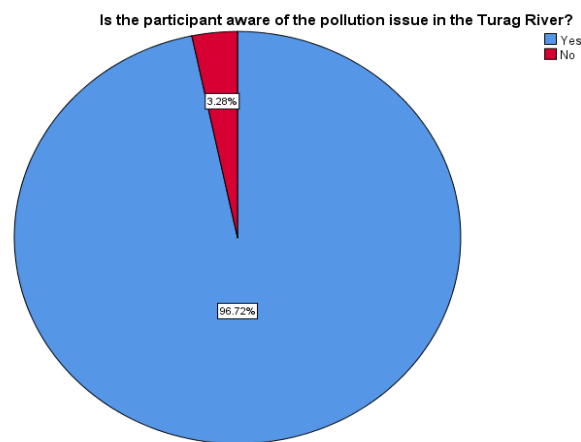| Is the participant aware of the pollution issue in the Turag River?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	265	92.0	96.7	96.7
	No	9	3.1	3.3	100.0
	Total	274	95.1	100.0	
Missing	System	14	4.9		
Total		288	100.0		

Table 4. Public Awareness of Pollution Issue

This table presents data on participants' awareness of the pollution issue in the Turag River, indicating the extent of public consciousness about environmental concerns impacting this particular river. From a total of 288 participants, 274 gave valid responses regarding their awareness of the pollution issue. There are 14 missing responses, which make up 4.9% of the total sample.

Out of those who responded, 96.7% or 265 participants are aware of the pollution problem in the Turag River. The significant percentage reflects a broad understanding among the participants about the river's environmental condition, indicating that the pollution issue is widely acknowledged within the study's demographic. Out of the valid responses, only 9 participants, which is 3.3%, mentioned not being aware of the pollution issue. This small percentage indicates that there is little lack of awareness about the river's condition among the participants, emphasizing effective communication or public exposure to information about environmental issues. The high awareness rate (92.0% of the total participants and 96.7% of valid responses) suggests a potentially significant level of concern or interest in environmental issues among the

participants. This could also indicate the seriousness of the pollution problem in the Turag River, making it a significant subject within the community or among the participants of the study.

Having some missing data (14 responses) could slightly affect how the data is interpreted, but it doesn't take away from the strong evidence of high awareness levels about the pollution problem. The data highlights the importance of ongoing environmental education and action, considering the widespread acknowledgment of the issue among those surveyed.

Is the participant aware of the pollution issue in the Turag River?

This pie chart shows how participants are aware of the pollution issue in the Turag River. Most of the chart is blue, indicating that 96.72% of the participants are aware. This extensive section emphasizes that almost all of the individuals surveyed are aware of the environmental issues affecting the Turag River. The small red slice shows that 3.28% of participants are unaware of the pollution, highlighting the low number of individuals who may not be informed or engaged with this environmental issue. The clear difference between the blue and red areas highlights the disparity in awareness levels among the participants.

The significant majority indicates that the pollution of the river is well-known among those surveyed, possibly showing effective information sharing or strong public involvement in local environmental concerns. This could indicate a notable public

perception of the issue, implying that it is a widely discussed topic in the community or in the media. There might be a small group of people who are not informed, possibly due to being less involved in local environmental issues or having limited access to information. Dealing with this gap presents a chance for specific educational initiatives or outreach programs within the community.

In general, the pie chart does a good job of showing how aware the participants are about the pollution of the Turag River. It indicates that efforts to tackle this problem would have a solid base of public awareness to start from.

Severity of Pollution	Frequency	Percent	Valid %	Cumulative %	Affects Daily Life	Frequency	Percent	Valid %	Cumulative %
Very Severe	171	59.4%	62.6%	62.6%	Yes	194	67.4%	70.3%	70.3%
Severe	64	22.2%	23.4%	86.1%	No	55	19.1%	19.9%	90.2%
Moderate	6	2.1%	2.2%	88.3%	Not Sure	27	9.4%	9.8%	100.0%
Mild	11	3.8%	4.0%	92.3%					
Not Sure	21	7.3%	7.7%	100.0%					
Total	273	94.8%	100.0%		Total	276	95.8%	100.0 %	
Missing	15	5.2%			Missing	12	4.2%		
Total Participants	288	100.0%			Total Participants	288	100.0%		

Table 5. Effects of Pollution on Everyday Activities

The table summarizes how participants view the pollution in the Turag River and its effects on their everyday activities. Most of the participants, 171 or 62.6% of those who responded, consider the pollution to be "Very Severe," showing a clear agreement on the seriousness of the environmental problem. 64 individuals, accounting for 23.4% of

valid responses, view the pollution as "Severe." Together with those who perceive it as "Very Severe," this group makes up 86.1% of the participants. It shows that most people see pollution as a crucial problem. Out of the total participants, only 6 (2.2%) view the pollution as "Moderate," and 11 (4.0%) perceive it as "Mild," indicating that a small number of participants think the pollution is not a major issue. Furthermore, 21 participants (7.7%) expressed uncertainty regarding the severity, possibly suggesting a lack of direct knowledge or uncertainty about the pollution's extent.

Regarding the pollution's effect on daily life, a significant majority of participants, 194 or 70.3%, feel that the pollution in the Turag River impacts their daily lives, emphasizing the direct relevance and potential personal consequences of environmental issues. Out of the total participants, 55 individuals (19.9%) do not think that the pollution in the river impacts their daily life. This could be due to their distance from the river or because they don't see how it relates to them personally. The "Not Sure" category, with 27 responses (9.8%), indicates a group of participants who seem uncertain about the impact. This uncertainty could stem from various reasons like insufficient information, indirect effects, or ambiguity regarding what defines "impact" on daily life.

The table includes information on missing data, with 15 (5.2%) and 12 (4.2%) participants not responding to pollution severity and its impact on daily life. The absence of this data might have a minor impact on result accuracy, but it does not significantly alter the overall trends identified.

Overall, the data shows that participants are highly aware and concerned about the pollution issue in the Turag River, with most recognizing its severity and impact on their daily lives. This recognition highlights the significance of tackling environmental issues and the necessity for potential intervention to reduce the impacts of pollution.

This data is essential for policymakers, environmental agencies, and public health officials to develop specific actions and communication strategies to address the pollution issue in the Turag River and its wider impact on the community.
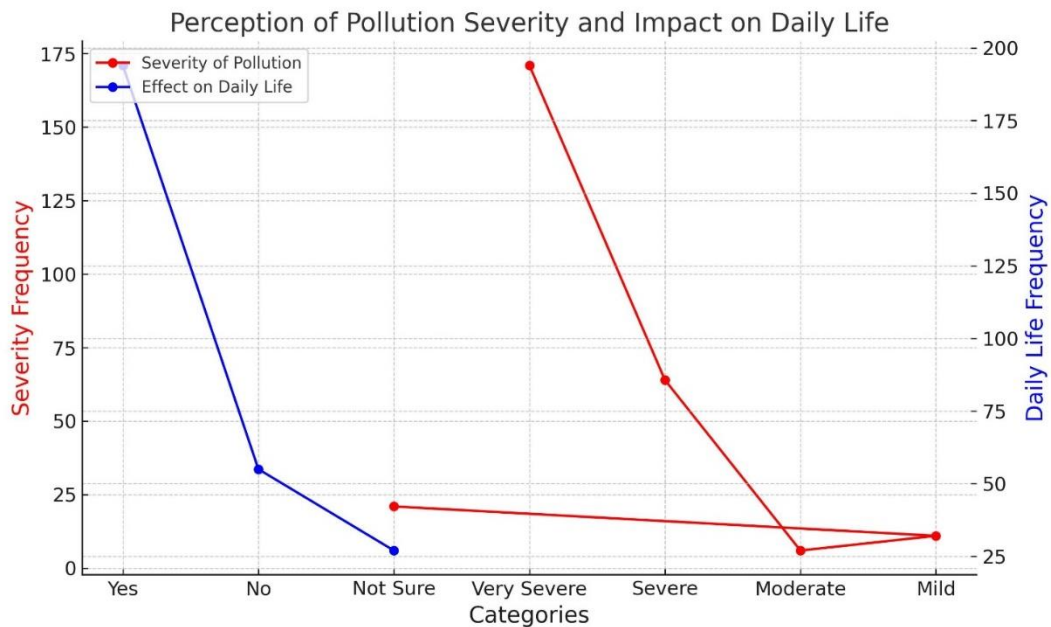
Figure 2.   Perception of Pollution Severity and Its Impact on Daily Life

A line graph to show the severity of pollution in the Turag River and its impact on daily life would probably reveal two clear trends. The severity of pollution line is likely to start high at 'Very Severe', showing that most participants view pollution as a critical issue. The data shows a sharp decline in the number of participants who categorized the pollution as 'Severe', 'Moderate', or 'Mild', with a slight uptick in those who selected 'Not Sure', indicating uncertainty among some participants about the severity.

The second line would reveal that most participants believe pollution affects their daily lives, with a majority affirming an impact ('Yes'). This reflects the significant concern among participants regarding the personal impact of environmental issues. The line would decrease at 'No', indicating a smaller group that does not perceive a direct impact, and then stabilize at 'Not Sure', where some participants are uncertain of the pollution's impact on their daily activities.

When comparing the two lines on the graph, it seems to indicate a relationship between the perceived severity of pollution and its impact on daily life. As the perceived severity decreases, the belief in its impact on daily life also decreases. Nevertheless, the 'Very Severe' and 'Yes' categories are expected to demonstrate the most substantial response, highlighting the significance of the issue to the participants.

The graph provides a visual representation of the connection between environmental awareness and perceived personal impact, crucial for policymakers and environmental agencies to consider when planning interventions. Overall, the graph would clearly show the participants' deep awareness and concern about the pollution in the Turag River and its impact on their lives.

Are there any economic activities being affected by the pollution in the Turag River?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	214	74.3	78.4	78.4
	No	37	12.8	13.6	91.9
	Not sure	22	7.6	8.1	100.0
	Total	273	94.8	100.0	
Missing	System	15	5.2		
Total		288	100.0		

Table 6. Impact on Economic Activities

This table offers an analysis of the economic impact of pollution in the Turag River. Among the 288 participants, a significant majority of 214 or 78.4% of those who gave valid responses believe that economic activities are impacted by the river's pollution. There is a clear agreement indicating that many people acknowledge the harmful economic effects of environmental damage in the area. Out of the 37 participants who do not think pollution is impacting economic activities, they make up 13.6% of the valid

responses. This suggests a smaller portion of the sample that either hasn't seen an effect or thinks the current economic activities are strong enough to withstand or are not connected to the river's state. Some of the participants, 22 or 8.1%, seem unsure about the economic impact.

This could suggest a limited exposure to economic activities related to the river or a lack of understanding of the pollution's wide effects. The cumulative percentage column demonstrates a growing recognition of the pollution's effects as the categories progress from 'No' to 'Yes,' ultimately resulting in a significant majority acknowledging an economic impact. The table indicates missing data, with 15 participants (5.2%) not providing any information on this question, hinting at a slight non-response that may stem from different reasons, like lack of knowledge or indifference. This data highlights the importance of conducting environmental and economic assessments to fully grasp the effects of pollution and develop strategies to reduce these impacts. Moreover, the significant number of 'Yes' answers might suggest tangible economic impacts in sectors like fisheries, agriculture, or tourism, which are easily noticeable by the community.

This awareness may also indicate the river's significance to the local economy and the crucial need for interventions to avoid additional economic losses from pollution. Ultimately, the table highlights a notable issue among participants regarding the connection between environmental health and economic prosperity, underscoring the significance of sustainable practices and pollution control to protect both ecological and economic welfare.

Are there any economic activities being affected by the pollution in the Turag River?
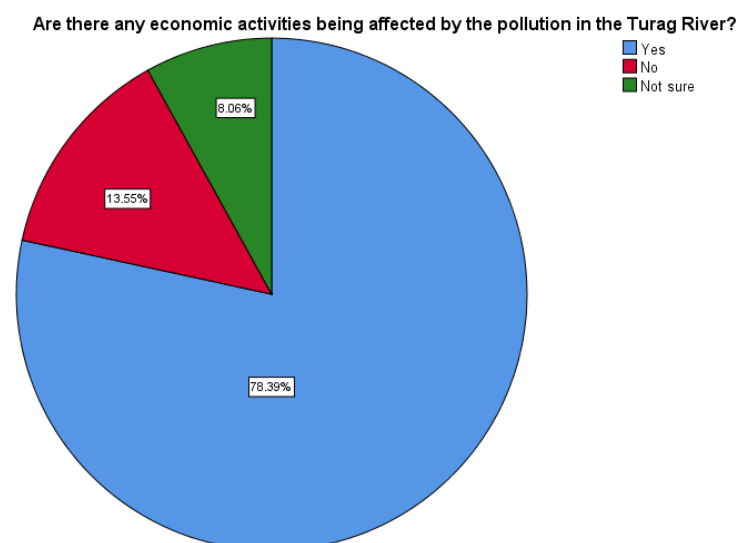
The pie chart gives a visual overview of participants' views on the impact of pollution on economic activities related to the Turag River. The majority of respondents, 78.39%, believe pollution is impacting economic activities, highlighting a significant concern within the community regarding environmental-economic connections. The red slice, representing 13.55%, indicates a smaller group of participants who do not perceive any impact from pollution on economic activities. This could suggest a lack of direct involvement with affected economic sectors or a different understanding of the economic impact. The green segment, which is 8.06% of the total, shows the respondents who are uncertain about the impact of pollution. This indicates that some people might lack sufficient information to form a well-informed opinion or could be experiencing indirect effects. Overall, the pie chart highlights a widespread acknowledgment of the adverse effects of environmental degradation on people's lives, possibly prompting the need for intervention and sustainable river management approaches.

Impact Question	Yes	No	Not Sure	Total Responses	Percent	Valid Percent	Cumulative Percent	Missing Responses
Effect on Local Businesses	256	4	10	270	93.8%	100.0%	100.0%	18
Impact on Public Health	258	1	13	272	94.4%	100.0%	100.0%	16

Table 7. Effect on Local Business and Impact on Public Health

This table combines responses to two important issues related to the impact of the Turag River's pollution: its influence on local businesses and its effects on public health. Among the 288 participants, the responses indicate significant concern among the local population regarding the consequences of the river's damaged ecological condition.

When it comes to the economic impact, a significant majority of respondents, specifically 256 out of 270, or 94.8% of those with valid responses, recognize the impact of the river's pollution on local businesses. There seems to be a strong

understanding in the community about how pollution can harm the local economy. With just 4 respondents (1.5%) thinking local businesses are not affected and 10 (3.7%) unsure, it's clear that there is a consensus on the negative economic impact. Out of the total survey population, 18 responses are missing, which is 6.3% of the total. However, this does not greatly impact the validity of the observed trend. The implications for public health are seen in a comparable light, with 258 participants (94.9%) acknowledging an impact, highlighting a nearly equal level of concern as that for local businesses. It's highly probable that the impact of pollution is widely acknowledged or directly experienced, given that only 1 respondent (0.4%) doesn't see a health impact and 13 (4.8%) are unsure. In this scenario, there are slightly fewer non-responses, with 16 missing answers accounting for 5.6% of the total. The widespread agreement that pollution negatively impacts both economic activities and public health highlights the importance of addressing the state of the Turag River as a crucial community concern. It might indicate a decrease in business profits in industries reliant on the river, like fishing, agriculture, or tourism. Regarding public health, it could indicate a growing awareness of health problems in the population, linked to polluted water.

The alignment of the two questions indicates that survey participants connect environmental health with both economic prosperity and physical health, demonstrating a holistic view of sustainability. The high percentage of 'Yes' responses suggests strong potential for support for environmental cleanup initiatives, as the population may be facing or expecting negative consequences from the pollution.

This data could be a strong motivator for policymakers, public health officials, and environmental organizations. The community is emphasizing the need for immediate action to combat pollution in order to protect the river ecosystem, local economy, and public health. The table not only shows perceptions but also represents a community's desperate call for help. This highlights the importance of implementing thorough strategies to reduce the impact of pollution, as well as the significance of engaging local communities in these efforts. The community's strong awareness and concern can be valuable resources for involving them in managing the river's health and reducing its effects on business and health.

Has anyone encountered health difficulties they believe are linked to the contamination of the Turag River?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	200	69.4	76.3	76.3
	No	62	21.5	23.7	100.0
	Total	262	91.0	100.0	
Missing	System	26	9.0		
Total		288	100.0		

Table 8. Data on Personal Health Issues

Here is the data on personal health issues linked to the pollution of the Turag River. Out of 262 valid responses, 200 individuals, which is about 76.3% of the respondents, stated they have experienced health issues they think are related to the river's pollution. This indicates a significant personal impact and concern among the participants, with most likely facing direct adverse health effects from the environmental issue.

On the other hand, 62 participants, accounting for 23.7% of the valid responses, do not attribute any health problems to the pollution. This could suggest limited exposure to the polluted environment or a different interpretation of the cause of their health concerns. The non-response rate of 9.0% (26 out of the total 288 participants) is relatively high, indicating a potential lack of awareness regarding the river's condition or uncertainty about the cause of health issues among this particular group of participants. This data emphasizes the significant public health impact of environmental degradation and the importance of health and environmental authorities addressing community concerns.

Has anyone encountered health difficulties they believe are linked to the contamination of the Turag River?

■ Yes
■ No

23.66%
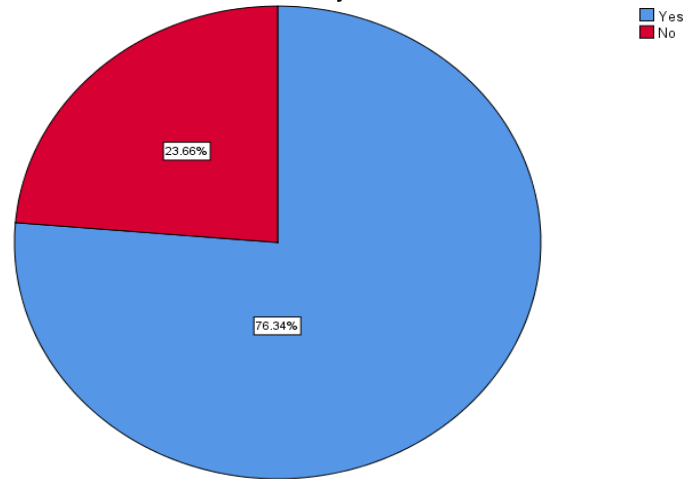
76.34%

This pie chart shows how many participants think their health issues are linked to the pollution of the Turag River. Most respondents, 76.34%, answered 'Yes', indicating that they have personally experienced health issues they attribute to the river's pollution. On the other hand, a smaller portion, 23.66%, do not connect their health issues to the river, suggesting a possible lack of impact or other factors affecting their health. The chart clearly shows how worried the public is about the environmental health risks caused by the river's pollution. This visual representation could be a powerful tool to show health authorities and policymakers the importance of taking immediate action to tackle the environmental and health issues facing the affected population.

Quality of Life Impact	Frequency	%	Valid %	Cumulative %	Pollution Issue Importance	Frequency	%	Valid %	Cumulative %
Improved	22	7.6%	8.2%	8.2%	Very Important	240	83.3%	87.0%	87.0%
Unchanged	176	61.1%	65.9%	74.2%	Important	29	10.1%	10.5%	97.5%
Declined	69	24.0%	25.8%	100.0%	Somewhat Important	7	2.4%	2.5%	100.0%
Total Responses	267	92.7%	100.0%		Total Responses	276	95.8%	100.0%	

Missing Responses	21	7.3%			Missing Responses	12	4.2%	
Total Participants	288	100.%			Total Participants	288	100.0%	

Table 9. Quality of Life in Areas affected by Turag River pollution

The table summarizes the viewpoints of participants regarding the quality of life in areas affected by Turag River pollution and the importance they place on addressing these environmental concerns. Out of 22 respondents, a small number think that the quality of life has gotten better. This could be due to benefits from the river despite pollution or a belief that the situation is being handled well.

Most people, with 176 responses, believe that the quality of life has stayed the same. This could show the community's ability to adapt to the environment or that there hasn't been a significant impact on daily life. On the other hand, 69 participants feel that the quality of life has decreased, supporting worries about the adverse effects of pollution, which could be linked to health, economic, or social aspects. The data indicates a clear acknowledgment of the seriousness of the pollution issue, with 240 participants emphasizing the importance of addressing pollution in the Turag River. This statement highlights the community's strong focus on environmental health and indicates robust backing for pollution-reducing measures. An extra 29 participants consider the issue 'Important', while 7 view it as 'Somewhat Important', showing a strong consensus among respondents on the problem's significance. This issue is not only prevalent but also deeply significant, as 97.5% of participants recognize its importance to some extent. The response rate for addressing pollution is currently at 95.8%, indicating that the issue is a significant concern within the community. The high level of engagement indicates that efforts to clean up the river would probably be well-received and backed by the local community. It's possible that the missing responses for both quality of life and importance of pollution issues, although minimal, could indicate a group of people who are not fully engaged with environmental issues or find it difficult to express their

thoughts. These gaps suggest possible areas that may require additional outreach or education to encourage community-wide involvement.

Overall, the table analysis shows differing opinions on the impact of river pollution on quality of life, but there is a clear agreement on the need to address the pollution. This shows a strong push for action from the participants, encouraging relevant authorities to focus on environmental restoration and protection efforts.

4.2. Findings

Impact Category	Yes	No	Not Sure	Total Responses	Percent Agreeing	Missing Responses
Economic Activities Affected	214	37	22	273	78.4%	15
Local Businesses Affected	256	4	10	270	94.8%	18
Public Health Impacted	258	1	13	272	94.9%	16
Health Difficulties Reported	200	62	--	262	76.3%	26
Quality of Life Declined	69	--	176	267	25.8%	21
Importance to Address Pollution	240	--	36	276	87.0% (Very Important)	12

Table 10. Seriousness of the Situation regarding the Turag River Pollution

The comprehensive findings table effectively captures the seriousness of the situation regarding the Turag River, providing a detailed overview of the community's challenges with the impacts of water pollution. It's evident that the contamination of the river has had a significant impact on economic activities and local businesses, with a large majority of participants recognizing this. The impact on businesses, such as those relying on the river for resources, trade, or agriculture, highlights the important connection between environmental health and economic sustainability. It's pretty clear that pollution is seriously affecting public health, with almost everyone recognizing its

impact and a large number of people experiencing health issues, highlighting a major public health problem. These statistics show a community facing health issues due to contaminated waters, such as waterborne diseases, limited access to clean water, and overall ecological health risks. Although most participants did not notice a change in their overall quality of life, a significant percentage (25.8%) reported a decline in their quality of life. This may indicate a delay in recognizing long-term consequences or a strong resilience among the affected population. Surprisingly, there is a clear call to action, with 87% of participants emphasizing the need to address the pollution as 'Very Important'. This indicates a community aware of the risks and ready for solutions. There seems to be a significant number of missing responses in various impact categories, which could point to a lack of awareness or involvement. This highlights the importance of enhancing environmental education and communication efforts.

Overall, the results show a community greatly affected by the deterioration of the Turag River, emphasizing a unanimous call for prompt and efficient action. This data strongly urges policymakers, health authorities, and environmental bodies to pay attention and take advantage of the community's willingness to work together towards ecological restoration and economic resilience.

4.3. Result and Discussion

Frequently analyzing data on the Turag River's water pollution reveals significant effects on economic development and social well-being, highlighting the river's crucial importance to nearby communities. The survey results clearly show a significant story of distress and the pressing need for intervention. From an economic standpoint, the data clearly shows that pollution has had a negative impact on economic activities, with 78.4% agreeing with this view. Local businesses are significantly impacted, with 94.8% of participants recognizing the negative effects of pollution.

This situation may be due to the reliance of these businesses on the river for resources, transport, and agriculture, all of which are currently at risk. One possible reason for the

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economic decline could be the decrease in the quality of goods, along with the additional expenses for purification or finding alternative sources, and the impact of losing river-based trade routes. This scenario not only indicates a current financial setback but also prompts worries about the future economic viability. Businesses play a vital role in the local economy by offering jobs and services. If they face challenges, it could lead to wider socio-economic issues like higher poverty rates and increased migration. The survey results regarding public health are concerning, as 94.9% of respondents view the river's contamination as a public health hazard. Supporting this perception is the significant number of people experiencing health issues directly related to the pollution (76.3%).

The health problems mentioned are not clearly outlined in the data. However, it can be assumed that they could vary from sudden illnesses caused by direct contact to ongoing issues from prolonged pollution. It's interesting that the survey shows a general awareness of environmental and health concerns, but there seems to be less recognition of the decrease in quality of life, as only 25.8% mentioned a perceived decline. It may indicate a certain level of acceptance of the situation, a psychological adjustment, or a sign that the most serious outcomes have not yet been fully realized in everyday life.

Nevertheless, the community is very clear about the significance of addressing pollution; 87% of participants consider it crucial to tackle the river's issues. The vast majority indicates a community that is not only informed but also deeply concerned and prepared to take action. The absence of responses in different categories is a subtle but important aspect of the survey. These absences may indicate a portion of the community that is disconnected, perhaps because they do not fully grasp the issues or feel powerless to make a difference. When looking at these findings, it's important to think about how water pollution is a complex problem that touches on economics, health, and social systems.

The pollution in the river is not just a simple environmental issue, but a multifaceted crisis that impacts various aspects of life. This situation requires a multidisciplinary approach to tackle both the contamination and the related economic vulnerabilities and

health risks. The discussion regarding the Turag River requires the involvement of economists, health experts, environmental scientists, and policymakers. The community's preparedness for action, as shown by the survey results, is a valuable asset. It is crucial to combine collective efforts, public-private partnerships, and community-based interventions with strict enforcement of environmental regulations. Reviving the river could spark economic growth and improve the overall well-being of the community.

Ultimately, the findings of this survey highlight the urgent requirement for comprehensive, long-lasting, and community-focused approaches to address the pollution of the Turag River. It is evident that the community is demanding action; now we need to turn this demand into practical policies and practices.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1. Conclusion

We have determined, via the examination of a variety of evidence, that Bangladesh as a whole is suffering as a result of the pollution that is occurring in the Turag river. At the outset, we endeavored to determine the manner in which we are being impacted by this pollution. We have arrived at the conclusion, based on the many facts and survey data, that our nation is suffering from this pollution from a variety of different aspects, one of which is the economic sector.

Over a period of time, the fishermen have been harmed as a result of this pollution, which has had a significant impact on the fishing industry along the Turag River. Based on the most recent information available, the fishing industry in this region is currently on the verge of collapsing. As the level of pollution increased, the reproductive process of the fish was disrupted, which ultimately led to the current state of affairs that we find ourselves in.

Additionally, it has a significant influence on the health of the individuals who live in this area. These filthy waters are required to be utilized by the general populace, particularly those who reside on the banks of the river, for the usual functions. From this point forward, the sickness is spreading. The number of germs that are found in the bodies of children and other individuals is growing as a result of this. Consequently, as a consequence of this, individuals are growing uneasy with regard to their work and their earnings.

Furthermore, the life of the average person is being negatively impacted in a variety of other ways by the dirty water. This area's tourism industry has been completely obliterated. Traffic has caused harm to the river over the years. Because of this, it is possible to assert that the nation and the people as a whole will be forced to endure hardships.

In this study, we have made an effort to shed light on the factors that contribute to this pollution. Alongside the waste from industrial processes, we also witness the ordinary

individuals who are accountable for it. The river has been polluted by the industrial effluents that have been mingled with the water, and the current condition of the river is the result of the carelessness of the people. In order to save this river, we need to exercise extreme caution, and at the same time, we need to devise a strategy that will allow us to restore it to the way it was before.

5.2.   Recommendations

1. Enhance Environmental Regulations: Implement strict environmental regulations for industries located along the Turag River, imposing significant penalties for violations to prevent pollutants from contaminating the waterway.

2.   Community Engagement Programs: Implementing community-led monitoring initiatives to empower locals to report pollution and participate in conservation efforts, fostering a sense of stewardship over the river's well-being.

3. Public Health Initiatives: Create thorough public health campaigns to inform the public about the dangers of water pollution and offer support for dealing with health problems caused by polluted water.

4. Economic Diversification: Promote and assist in the creation of different sources of income that are not reliant on the river's condition, to lessen the financial effects of pollution on nearby businesses and communities.

5. Consider investing in advanced water treatment facilities for the river, such as filtration and purification technologies, to decrease pollutants and protect the water supply for human and ecological needs.

6. Restoration Projects: Implement river restoration projects such as reforestation along riverbanks, wetland creation for natural pollutant filtration, and community clean-up events to eliminate trash and other physical contaminants.

7. Policy Advocacy and Research: Propose conducting thorough research on the lasting impacts of pollution on the economy and public health, utilizing the results to shape policy creation and resource distribution.

CHAPTER 6: REFERENCES

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