Alag-Malaylay River

CY 2021

CLASSIFICATION REPORT

Department of Environment and Natural Resources
ENVIRONMENTAL MANAGEMENT BUREAU
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Contents

I. Executive Summary 1
II. Brief Introduction 3
III. Objectives of Classification 6
IV. Methodology 7
V. Results and Discussion 9
VI. Recommendations 36
VII. Annexes and Attachments 38

I. Executive Summary

Philippines is an archipelagic country, which consists of approximately 7,641 islands. Philippines is enriched by wide range of natural landscapes and water forms. However, due to the rapid growth and technological innovation, natural resources particularly the quality of water have been directly affected. It was estimated that 91% of the population in the country has accessibility in basic water services.

Water encircles the flow of life in Earth. It is a valuable commodity which exist in abundance, however, only a small percentage of the Earth's water can be used for human activities and consumption. Philippines still struggles to provide an adequate water supply to all its citizens. Water scarcity will eventually result to unhygienic practices and reliance to drinking untreated water. Outbreaks due to foodborne and waterborne diseases will be prevalent mainly to places that have insufficient water supply. About 31% of diseases monitored for five years in the country were due to waterborne sources.

Heavy reliance to surface water and groundwater resources will be insufficient in the future due to growing water demand of the people and the climate change. The government are obliged to provide its citizens with adequate water suitable for human consumption. The National Government, LGUs and private sectors in the Philippines, have collaborated in educating the people regarding the relevance and effects of human activities in the water quality.

The Republic Act (RA) 9275, also known as the Philippine Clean Water Act of 2004 was enacted by the Philippine Congress to protect and preserve the Philippine water resources. Under RA 9275, it mandates the water quality management in all waterbodies in the country.

The DENR Administrative Order 08 series of 2016, otherwise known as the Water Quality Guidelines and General Effluent Standards of 2016 is mandated to classify the existing waterbodies in the country accordingly to its water quality and beneficial usage to promote the protection and conservation of the Philippines' water resources.

The classification of the waterbody is determined after a period of one year of monthly monitoring. Factors such as human activities, topography and laboratory analysis are considered in determining the appropriate classification for a waterbody. Public consultation is done to provide information to the public and to solicit their comments and suggestions.

The final proposed classification of Alag-Malaylay River System is class B for the following stations: Mangangan II and Sta. Rosa II. The intended beneficial uses of Class B waters based on DAO 2016-08 are:

1) **Recreational Water Class I** – Intended for primary contact recreation (bathing, swimming, etc.)

While for stations: Alag, Alag Bridge, Sta. Cruz, Malapad, Lumangbayan, and River Delta, the final proposed classification is Class C. The intended beneficial uses of Class SC waters based on DAO 2016-08 are:

1) **Fishery Water** for the propagation and growth of fish and other aquatic resources
2) **Recreational Water Class II** – For boating, fishing, or similar activities
3) For agriculture, irrigation, and livestock watering

II. Brief Introduction

Oriental Mindoro is one of the two provinces in the Mindoro Island under the jurisdiction of MIMAROPA Region. In the 2020 Census, Oriental Mindoro has a population of 908,339 with a land area of 4,238.38 square kilometers. Oriental Mindoro is bordered on the north by the Verde Island Passage, Sibuyan Sea and Tablas Straight in the east, Semirara and Antique in the south and Occidental Mindoro in the west.

Calapan City is the only existing city in Oriental Mindoro, and it also serves as its capital. Aside from Calapan City, there are 14 municipalities within Oriental Mindoro, namely, Baco, Bansud, Bongabong, Bulalacao, Gloria, Mansalay, Naujan, Pinamalayan, Pola, Puerto Galera, Roxas, San Teodoro, Socorro, and Victoria. The existing National Roads in Oriental Mindoro.

Baco is a third-class municipality situated in the northern part of Oriental Mindoro. It is bordered by San Teodoro in the northwest, Calapan City and Naujan in the east, Sablayan in the south, and Santa Cruz in the southwest. It is approximately 16 kilometers away from the capital city. It has mountainous terrain with agriculture, trading, and tourism as its main industries. Baco has a land area of 216.23 square kilometers with a population of 39,817 according to 2020 Census. Baco is politically subdivided into 27 barangays, namely, Alag, Bangkatan, Baras, Bayanan, Burbuli, Catwiran I, Catwiran II, Dulangan I, Dulangan II, Lantuyang, Lumang Bayan, Malapad, Mangangan I, Mangangan II, Mayabig, Pambisan, Poblacion, Pulang Tubig, Putican-Cabulo, San Andres, San Ignacio, Santa Cruz, Santa Rosa I, Santa Rosa II, Tabon-tabon, Tagumpay, and Water.

HISTORICAL BACKGROUND

Mindoro island has been cited in some of Chinese chronicles as the land "Ma'I" which the merchants of Mindoro conducts trading with the Chinese traders. Historians asserted that China-Mindoro ties must have existed before to 892 A.D., when the first Mindoro ship was documented to have traveled to China. According to historians, the initial settlers of Mindoro were Indonesians who arrived on the island between 8,000 and 3,000 years ago. Following the Indonesians, the Malay people arrived in Southeast Asia 200 BCE. Prior to settling in the Philippine Archipelago, it is thought that the

Malay people had substantial cultural contact with India, China, and Arabia. Miguel Lopez de Legaspi, the first Spanish Governor General of the Philippines, discovered Mindoro. In 1565, when Legaspi took Cebu, he learned about a thriving town in Luzon. The exploration that led to the discovery of this island, motivated by their desire for sufficient food supply, which was insufficient in most of the Visayas Islands. Captain Martin de Goiti and Juan de Salcedo set sail towards the island of Luzon.

Baco is known to be the oldest town in Oriental Mindoro. Its name “Baco” has two origins. First, it derives from the word "Paco," which refers to an edible fern that grew abundantly in the area, and secondly, according to folklore passed down by the elders, it originates from the word "Baku-bako," which refers to the road potholes left by the frequent flooding caused by heavy rain that lasted 3 to 4 days.

According to the Anthropologist and Missionary Reverend AntoonPostma, this town became the first Official Capital of Oriental Mindoro in 1575 due to the construction of the First Parochial Church in 1567. When Corregidor Joseph de Chavez became the Governor of Oriental Mindoro in 1678, Calapan became the capital of the province.

Baco is also endowed by many scenic destinations such as Dulangan, Bayanan, and Lantuyang Waterfalls; the Mangangan Tunnel; Carayrayan River; Cueva Sagrada (Sacred Cave); San Andres (The Sunken Town); Tiboy Rapids; Water Beach Area; Mayabig Core Dam; and Mt. Halcon, the third highest mountain in the Philippines.

ALAG-MALAYLAY RIVER SYSTEM

Alag-Malaylay River System comprises of contiguous stream of Alag River and Malaylay River. Alag River encompasses the barangays of Calangatan, and Bigaan in San Teodoro, barangays of Baras, Santa Rosa II, Mangangan II, Mangangan I, Alag, Santa Rosa I, Mayabig, Burbuli, Santa Cruz, Poblacion, Bayanan, Lantuyang in Baco which then merge to Malaylay River and continues to flow from Malapad, Lumangbayan, Pulang Tubig, Putican-Cabulo, Water, Catwiran I, and Catwiran II in Baco, Oriental Mindoro.

Alag River has an estimated terrain elevation of 7 meters above sea level, while the Malaylay River has an estimated terrain elevation of 1 meter above sea level. Alag-

Malaylay River stretches from the border of San Teodoro then encompassing the municipality of Baco. There are a total of eight (8) sampling stations within the river system, located in Sta. Rosa II, Mangangan II, Alag, Alag Bridge, Sta. Cruz, Malapad, Lumang Bayan, and the River Delta.

The upstream part of the river which is the Sta. Rosa II and Mangangan II has a proposed classification of Class B, while the rest of the river has proposed classification of Class C.

III. Objectives of Classification

The main objective of water body classification is to maintain the body of water in a safe and satisfactory condition according to its best usage. The secondary objectives are as follows:

❖ To determine the present quality of water body in relation to DENR's water quality criteria.
❖ To determine the actual best usage potential and dominant water utilization of the water body.
❖ To establish classification of water body as an important component in the water quality management and as a guide in the enforcement of general effluent standards as provided by the DENR AO 08 series of 2016: and
❖ To maintain the minimum condition necessary to assure the suitability of the water for its designated use or classification

WATER BODY CLASSIFICATION AND USAGE OF FRESH SURFACE WATER

CLASSIFICATION	INTENDED BENEFICIAL USE
Class AA	Public Water Supply Class I – Intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest PNSDW
Class A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment (coagulation, sedimentations, filtration and disinfection) to meet the latest PNSDW
Class B	Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, etc.)
Class C	1. Fishery Water for the propagation and growth of fish and other aquatic resources 2. Recreational Water Class II – For boating, fishing, or similar activities 3. For agriculture, irrigation and livestock watering
Class D	Navigable waters

IV. Methodology

Methodology for classifying a water body was based on the provisions of Department Administrative Order (DAO) No. 08 series of 2016 as the Water Quality Guidelines and General Effluent Standards of 2016. The process of classification was divided into six (6) phases, namely:

A. Ocular Inspection
B. Establishment of sampling stations and collection of water samples
C. Analysis and interpretation of data
D. Conduct public hearing
E. Submission of classification report
F. Publication

The significant parameters for Alag-Malaylay River System were selected based on the existing and potential sources of pollution found in the vicinity. The river was tested for its physical and chemical properties. A total of eight (8) monitoring stations were established each representing the upstream, midstream and downstream part of the river.

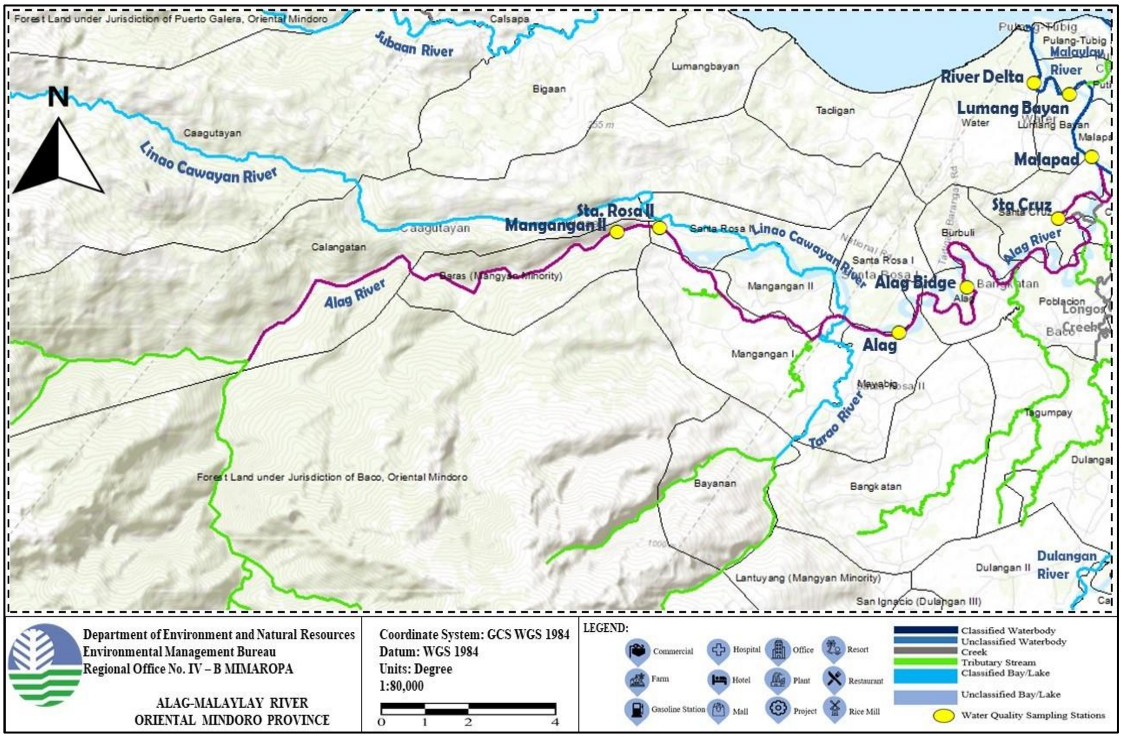
For the purpose of its classification, water samples were collected using grab sampling method last April 12, May 10, June 17, July 05, July 26, August 16, September 06, September 27, October 11, November 12, and November 26 of CY 2021. Measurements for pH, temperature and dissolved oxygen (DO) were taken in-situ using the YSI multi-parameter water quality checker. Prior to transport, samples were maintained at low temperature by packing it with ice to maintain uniform temperature of 4˚C before the laboratory analysis of color, biochemical oxygen demand (BOD), fecal coliform (FC), total suspended solids (TSS), nitrates and phosphates. All methods used for analysis were based on the approved method of analyses set forth in EMB MC No. 012 series of 2016 or the "EMB Approved Methods of Analysis for Water and Wastewater."

Secondary data was acquired from local government unit, internet and other national government agencies concern. Interviews with local residents, barangay officials and stakeholders were conducted to gather pertinent information on the actual and potential beneficial usage of Alag-Malaylay River System. In-situ and laboratory results data were presented to the concerned stakeholders through public consultation. Final classification report will be submitted to EMB Central Office for final evaluation, approval and publication.

The eight (8) established monitoring stations with its corresponding GPS coordinates are presented on the succeeding section. The coordinates were plotted using ArcGIS to map the whole stretch of Alag-Malaylay River System.

WATER QUALITY MONITORING STATIONS

Station No.	Station Identification	GPS Coordinates North	GPS Coordinates East
1	Sta. Rosa II	13º 22’ 44” N	121º 01’ 21” E
2	Mangangan II	13º 22’ 01” N	121º 02’ 01” E
3	Alag	13º 21’ 32” N	121º 04’ 04” E
4	Alag Bridge	13º 22’ 05” N	121º 4’ 51” E
5	Sta. Cruz	13º 22’ 05” N	121º 5’ 51” E
6	Malapad	13º 23’ 32” N	121º 06’ 15” E
7	Lumang Bayan	13º 24’ 12” N	121º 06’ 00” E
8	River Delta	13º 24’ 20” N	121º 05’ 34” E



Plotted Monitoring Stations of Alag-Malaylay River System using ArcGIS

V. Results and Discussion

Parameters Monitored with Corresponding Analytical Data and Assessment of Results

The significant parameters for the water quality measurement of the water of Alag-Malaylay River System are color, pH, dissolved oxygen, biochemical oxygen demand, temperature, total suspended solids, nitrates, phosphates and fecal coliform. The results of both in-situ and laboratory analyses conducted during the eleven (11) sampling periods are presented in the succeeding sections.

1. Color

In water quality, color is defined as the materials decayed from organic matter namely, vegetation and inorganic matter such as soil, stones and rocks. Humic matter consists of humic and fulvic acids; both causes yellow-brown color. Humic acid gives more intense color, and the presence of iron intensifies the color through the formation of more soluble ferric humates. Suspended particles, especially colloidal-size particles such as clays, algae, iron and manganese oxides, gives waters and appearance of color i.e. the brownish color of water is due to the presence of iron and the greenish color in the water is due to the presence of organic substances including algae.

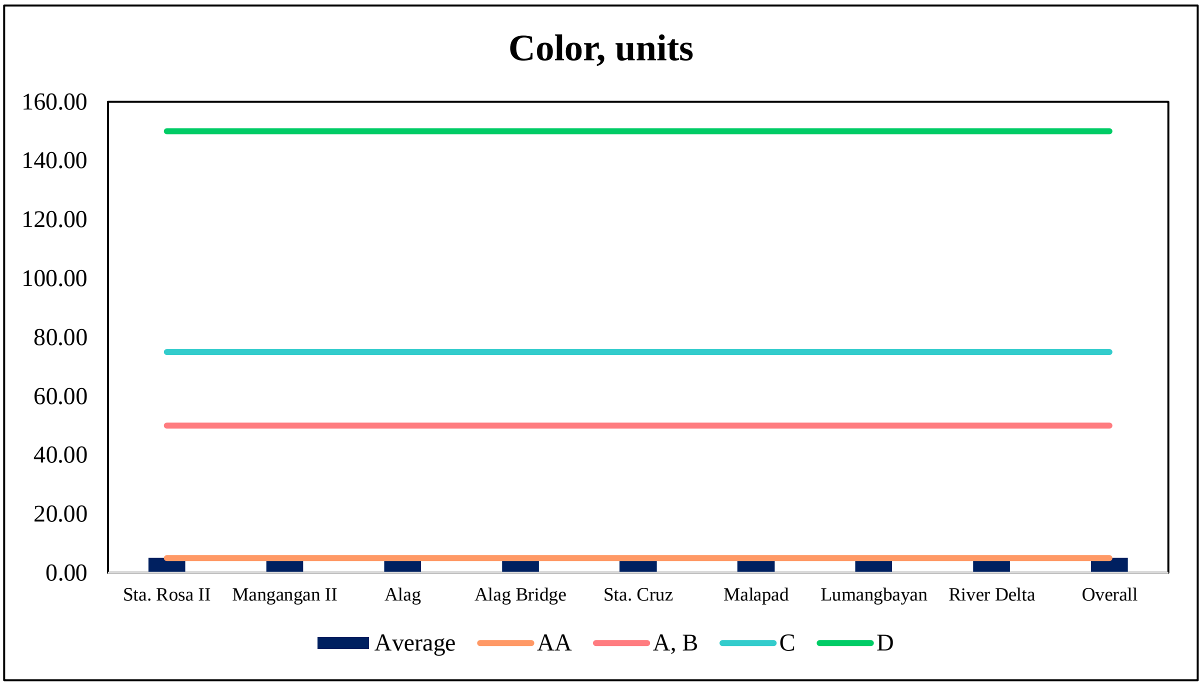
Color is measured by comparing the water sample with standard color solutions or colored glass disks. The Platinum-Cobalt Method of measuring color is the standard method, the unit of color is the standard method, unit of color being that produced by 1mg platinum/L in the form of chloroplatinate ion.

Table 1: Results for Color

Station Identification	April 12, 2021	May 10, 2021	June 17, 2021	July 05, 2021	July 26, 2021	August 16, 2021
Sta. Rosa II	5	5	5	5	5	5
Mangangan II	5	5	5	5	5	5
Alag	5	5	5	5	5	5
Alag Bridge	5	5	5	5	5	5
Sta. Cruz	5	5	5	5	5	5
Malapad	5	5	5	5	5	5
Lumangbayan	5	5	5	5	5	5
River Delta	5	5	5	5	5	5
Overall	**5**	**5**	**5**	**5**	**5**	**5**

Station Identification	September 06, 2021	September 27, 2021	October 11, 2021	November 12, 2021	November 26, 2021
Sta. Rosa II	5	5	5	5	5
Mangangan II	5	5	5	5	5
Alag	5	5	5	5	5
Alag Bridge	5	5	5	5	5
Sta. Cruz	5	5	5	5	5
Malapad	5	5	5	5	5
Lumangbayan	5	5	5	5	5
River Delta	5	5	5	5	5
Overall	**5**	**5**	**5**	**5**	**5**

Station Number	Station Identification	Average Color	Min	Max	Water Quality Guidelines DAO 08 s. 2016				
					AA	**A**	**B**	**C**	**D**
1	Sta. Rosa II	5	5	5	5	50	50	75	150
2	Mangangan II	5	5	5					
3	Alag	5	5	5					
4	Alag Bridge	5	5	5					
5	Sta. Cruz	5	5	5					
6	Malapad	5	5	5					
7	Lumangbayan	5	5	5					
8	River Delta	5	5	5					
Overall		**5**							



Highly colored water has significant effects on aquatic plants and algal growth. Colored water can limit the penetration of light which is essential for the growth of aquatic plants. Thus, a highly colored body of water could not sustain aquatic life which could lead to the long-term impairment of the ecosystem. High algal growth in a water body can block light and deplete dissolved oxygen, causing eutrophication.

Based on the graph above, all the sampling stations in Alag-Malaylay River System has an average of 5 color units, which is consistent to the low concentration of total suspended solids in the river. Low color concentration of the water indicates that there is a low presence of organic and inorganic substances. Overall, the average color concentration is 5 color units in the whole stretch of the river which is within the acceptable range of all classes in the WQG.

2. pH

In chemistry, pH is a measure of the acidity or basicity of an aqueous solution. It is an actual measurement of the potential activity of hydrogen ions in that solution. Pure water is said to be neutral, with a pH close to 7.0 at 25 °C. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. A solution of a strong acid, such as hydrochloric acid, at concentration 1 mol/L has a pH of 0. A solution of a strong alkali, such as sodium hydroxide, at concentration 1 mol/L, has a pH of 14. Thus, measured pH values will lie mostly in the range 0 to 14. Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a tenfold difference in hydrogen ion concentration. In other words, pH

6.0 is ten times more acidic than pH 7.0 and pH 5 is one hundred times more acidic than pH 7.0.

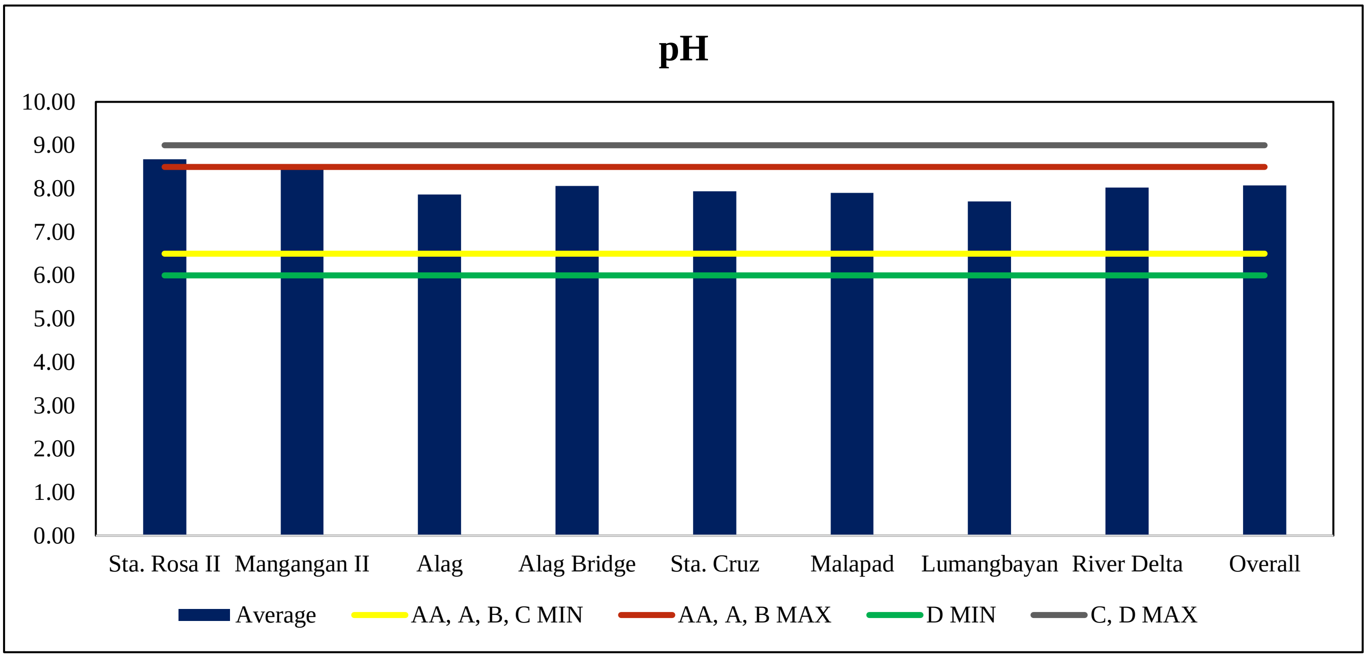
The pH of a body of water is affected by several factors. One of the most important factors is the bedrock and soil composition through which the water moves, both in its bed and as groundwater. Some rock types such as limestone can, to an extent, neutralize the acid while others, such as granite, have virtually no effect on pH. Another factor which affects the pH is the amount of plant growth and organic material within a body of water. When this material decomposes carbon dioxide is released. The carbon dioxide combines with water to form carbonic acid. Although this is a weak acid, large amounts of it will lower the pH. Dumping of chemicals into the water by individuals, industries, and communities would definitely affect the pH of a water body. Shampoo rinse water is actually a chemical brew and can affect the pH along with other chemical parameters of water. Many industrial processes require water of exact pH readings and thus add chemicals to change the pH to meet their needs. After use, this altered pH water is discharged as an effluent, either directly into a body of water or through the local sewage treatment plant. Acid precipitation that falls in the watershed is also another factor. Acid rain is caused by nitrogen oxides (NOx) and sulfur dioxide (SO_2) in the air combining with water vapor. These pollutants are primarily from automobile and coal-fired power plant emissions. Acid rain is responsible for many of our first order streams becoming acidic. Lastly, iron sulfide, a mineral found in and around coal seams, combines with water to form sulfuric acid is another great factor. Combined with the problem of acid rain, the pH of some stream waters can be drastically lowered.

Table 2: Results for pH

Station Identification	**April 12, 2021**	**May 10, 2021**	**June 17, 2021**	**July 05, 2021**	**July 26, 2021**	**August 16, 2021**
Sta. Rosa II	7.75	6.08	8.90	9.52	8.91	9.58
Mangangan II	5.64	6.11	8.85	9.65	8.8	9.37
Alag	5.31	5.81	7.86	8.27	8.76	8.62
Alag Bridge	7.59	5.85	7.94	8.23	8.53	8.48
Sta. Cruz	5.27	7.61	7.46	8.3	8.54	8.47
Malapad	5.75	6.1	7.70	8.2	8.47	8.68
Lumangbayan	5.43	5.95	7.79	7.99	8.53	8.15
River Delta	7.8	6.21	7.72	8.03	8.51	8.47
Overall	**6.32**	**6.22**	**8.03**	**8.52**	**8.63**	**8.73**

Station Identification	September 06, 2021	September 27, 2021	October 11, 2021	November 12, 2021	November 26, 2021
Sta. Rosa II	10.34	10.87	9.57	7.34	6.56
Mangangan II	9.57	11.03	9.30	7.72	6.92
Alag	9.23	9.90	8.59	7.96	6.20
Alag Bridge	9	9.86	8.45	7.66	7.12
Sta. Cruz	9.22	9.42	8.44	7.60	6.98
Malapad	9.02	9.66	8.63	7.64	7.13
Lumangbayan	8.63	9.40	8.13	7.72	7.02
River Delta	8.53	9.73	8.44	7.76	7.05
Overall	**9.19**	**9.98**	**8.69**	**7.68**	**6.87**

Station Number	Station Identification	Average pH	Min	Max	Water Quality Guidelines DAO 08 s. 2016				
					AA	**A**	**B**	**C**	**D**
1	Sta. Rosa II	8.67	6.08	10.87	6.50-8.50	6.50-8.50	6.50-8.50	6.50-9.00	6.00-9.00
2	Mangangan II	8.45	5.64	11.03					
3	Alag	7.86	5.31	9.90					
4	Alag Bridge	8.06	5.85	9.86					
5	Sta. Cruz	7.94	5.27	9.42					
6	Malapad	7.91	5.75	9.66					
7	Lumangbayan	7.70	5.43	9.40					
8	River Delta	8.02	6.21	9.73					
Overall		**8.08**							



3. Dissolved Oxygen (DO)

Oxygen saturation or dissolved oxygen (DO) in the environment generally refers to amount of oxygen that is dissolved or carried in the soil or water body. It can be measured with a dissolved oxygen probe such as an oxygen sensor or an opt ode in water. DO is measured either in milligrams per liter (mg/L) or "percent saturation." Milligrams per liter is the amount of oxygen in a liter of water. Percent saturation is the amount of oxygen in a liter of water relative to the total amount of oxygen that the water can hold at that temperature.

The physical factors that influence DO are temperature, altitude, salinity, and stream structure. Temperature inversely controls the solubility of oxygen in water. As temperature increases, oxygen is less soluble. In contrast, there is a direct relationship between atmospheric pressure and DO. As the pressure increases due to weather or elevation changes, oxygen solubility increases. Salinity also reduces the solubility of oxygen in water. Stream structure also influences DO concentrations. Atmospheric oxygen becomes mixed into a stream at turbulent, shallow riffles, resulting in increased DO levels. Because there is less surface interaction between water and air in slow-moving water and deep sections of a stream, DO concentrations often decrease between surface and bottom measurement.

Adequate dissolved oxygen is necessary for good water quality. Oxygen is a necessary element to all forms of life. Natural stream purification processes require adequate oxygen levels in order to provide for aerobic life forms. As dissolved oxygen levels in water drop below 5.0 mg/l, aquatic life is put under stress. The lower the concentration, the greater the stress. Oxygen levels that remain below 1-2 mg/l for a few hours can result in large fish kills.

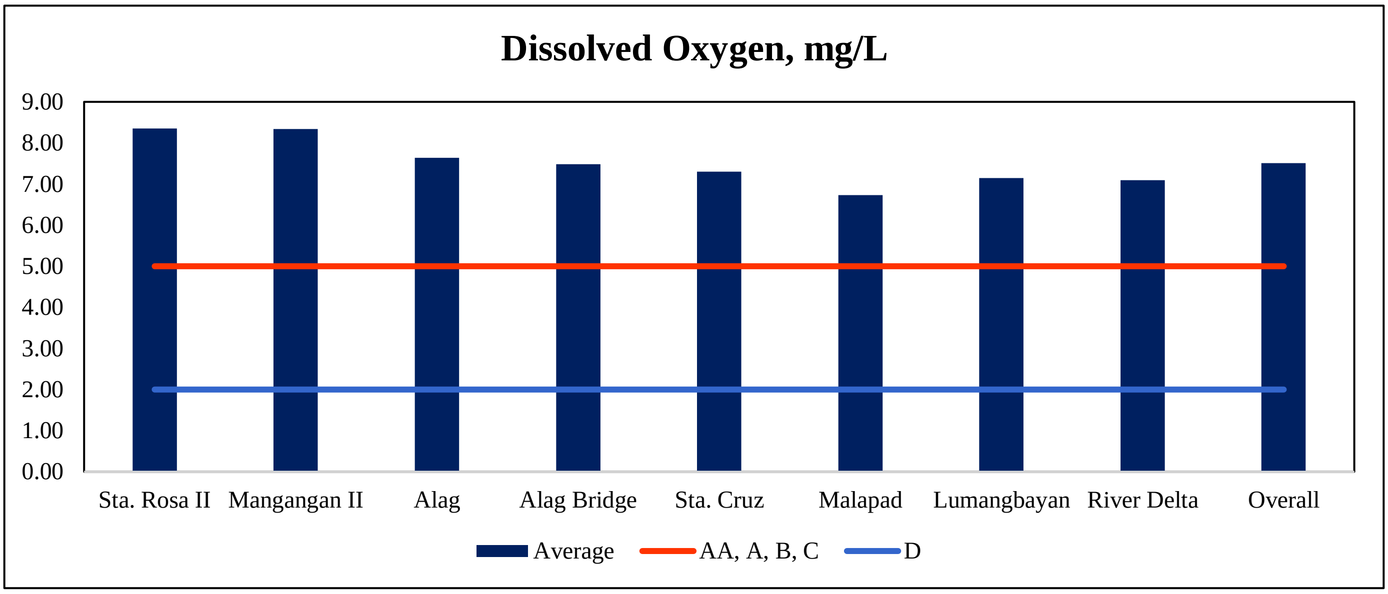
Total dissolved gas concentrations in water should not exceed 110 percent. Concentrations above this level can be harmful to aquatic life. Fish in waters containing excessive dissolved gases may suffer from "gas bubble disease". However, this is a very rare occurrence. The bubbles or emboli block the flow of blood through blood vessels causing death. External bubbles (emphysema) can also occur and be seen on fins, on skin and on other tissue. Aquatic invertebrates are also affected by gas bubble disease but at levels higher than those lethal to fish.

Table 3: Results for Dissolved Oxygen, mg/L

Station Identification	**April 12, 2021**	**May 10, 2021**	**June 17, 2021**	**July 05, 2021**	**July 26, 2021**
Sta. Rosa II	6.30	6.50	8.6	10.01	8.48
Mangangan II	6.00	6.80	8.5	9.35	7.93
Alag	6.50	6.60	7.85	7.78	8.18
Alag Bridge	6.20	6.00	7.69	7.7	8.05
Sta. Cruz	6.40	6.00	7.34	7.95	6.85
Malapad	6.10	6.20	6.95	7.36	7.01
Lumangbayan	6.50	6.20	7.84	7.2	7.52
River Delta	6.40	6.80	7.23	6.89	7.4
Overall	**6.30**	**6.39**	**7.75**	**8.03**	**7.68**

Station Identification	August 16, 2021	September 06, 2021	September 27, 2021	October 11, 2021
Sta. Rosa II	9.23	8.67	8.59	8.74
Mangangan II	9.32	9.09	9.07	8.99
Alag	7.95	7.98	8.02	7.88
Alag Bridge	7.88	7.93	7.9	7.94
Sta. Cruz	7.69	7.92	7.23	8.32
Malapad	4.61	7.42	7.37	7.57
Lumangbayan	7.06	7.57	7.24	7.18
River Delta	7.4	7.22	7.36	7.11
Overall	**7.64**	**7.98**	**7.85**	**7.97**

Station Number	Station Identification	Average DO	Min	Max	Water Quality Guidelines DAO 08 s. 2016				
					AA	A	B	C	D
1	Sta. Rosa II	8.35	6.30	10.01	5	5	5	5	2
2	Mangangan II	8.34	6.00	9.35					
3	Alag	7.64	6.50	8.18					
4	Alag Bridge	7.48	6.00	8.05					
5	Sta. Cruz	7.30	6.00	8.32					
6	Malapad	6.73	4.61	7.57					
7	Lumangbayan	7.15	6.20	7.84					
8	River Delta	7.09	6.40	7.40					
Overall		**7.51**							



Adequate supply of dissolved oxygen gas is essential for the survival of aquatic organisms. A deficiency in this area is a sign of an unhealthy river. There are a variety of factors affecting levels of dissolved oxygen. The atmosphere is a major source of dissolved oxygen in river water. Waves and tumbling water mix atmospheric oxygen with river water. Oxygen is also produced by rooted aquatic plants and algae as a product of photosynthesis.

A dissolved oxygen level of less than 6 mg/L can be harmful to the ecosystem of water bodies. Temperature, sea waves and salinity have direct impact to dissolved oxygen. An increase in temperature will increase salinity levels and decrease dissolved oxygen.

Based on the graph above, the stations of Sta. Rosa II and Mangangan II located in the upstream part of the river has the highest average dissolved oxygen concentration among other stations. Relatively, both stations have low average biochemical oxygen demand. BOD is the amount of dissolved oxygen being depleted by aerobic microorganisms as they decompose organic material at a certain temperature. As the level of dissolved oxygen decreases, the biochemical oxygen demand increases. Overall, Alag-Malaylay River System has an average dissolved oxygen concentration of 7.51 mg/L, which exceed the minimum required DO concentration of all five categories of classification of WQG of DENR Administrative Order 2016-08.

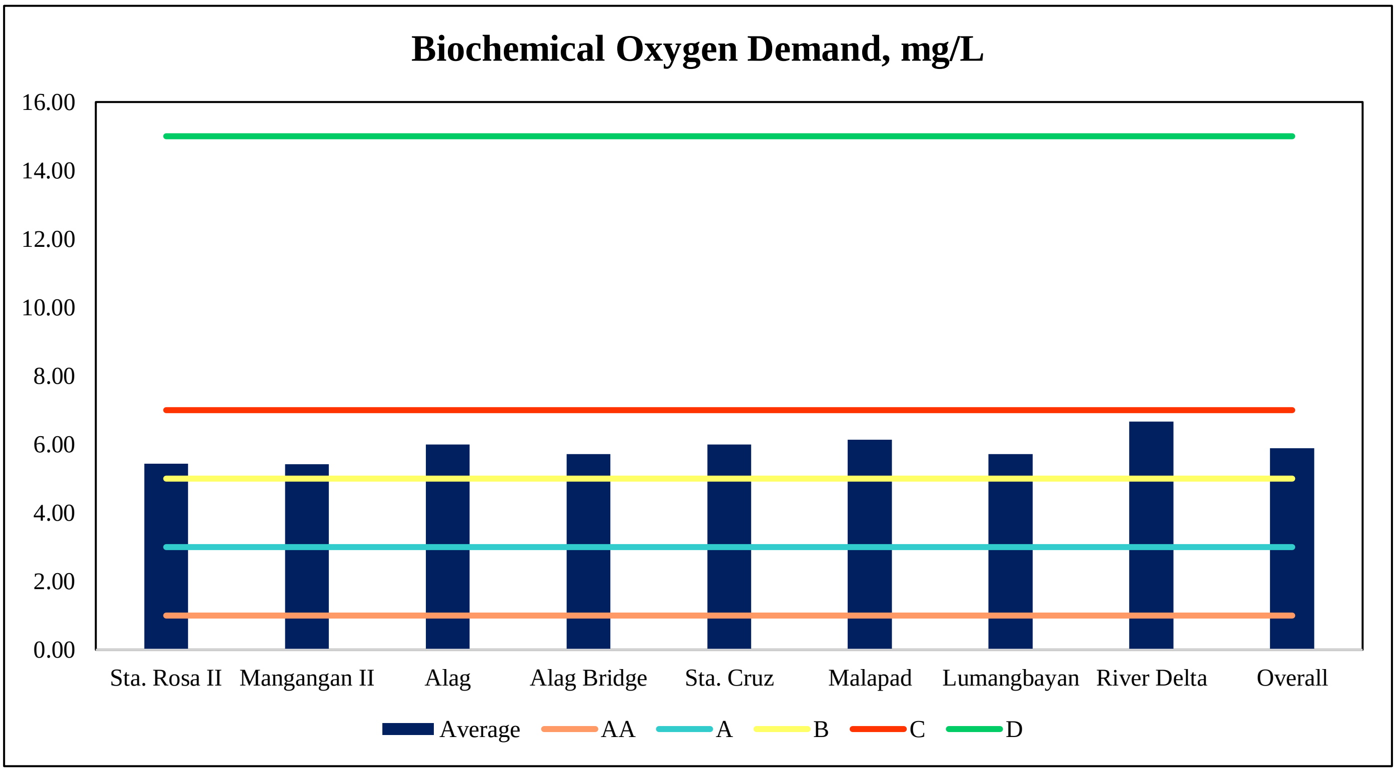
4. Biochemical Oxygen Demand

Bacteria and other microorganisms use organic substances for food. As they metabolize organic material, they consume oxygen. The organics are broken down into simpler compounds, such as CO2 and H2O and the microbes use the energy for growth and reproduction. When this process occurs un the water, the oxygen consumed is the DO (dissolved oxygen) in the water. If oxygen in water will not be replaced by natural or artificial means, the DO concentration will be depleted as the microbes decompose the organic materials. This need for oxygen is called the biochemical oxygen demand (BOD). Sometimes referred to as Biological Oxygen Demand, is a measure of the amount of oxygen required by aerobic microorganisms to decompose the organic matter in a sample of water. It is used as a measure of the degree of water pollution.

Table 4: Results for Biochemical Oxygen Demand, mg/L

Station Identification	**April 12, 2021**	**May 10, 2021**	**June 17, 2021**	**July 05, 2021**	**July 26, 2021**	**August 16, 2021**	**September 06, 2021**
Sta. Rosa II	6	5	6	5	3	9	4
Mangangan II	3	<1	5	9	5	9	6
Alag	8	5	4	7	4	8	6
Alag Bridge	6	6	4	4	5	9	6
Sta. Cruz	5	6	6	5	4	10	6
Malapad	5	4	8	6	4	9	7
Lumangbayan	5	5	6	6	5	6	7
River Delta	3	No Data	8	7	6	9	7
Overall	**5.13**	**4.56**	**5.88**	**6.13**	**4.5**	**8.63**	**6.13**

Station Number	Station Identification	Average BOD	Min	Max	Water Quality Guidelines DAO 08 s. 2016				
					AA	A	B	C	D
1	Sta. Rosa II	5	3	9	1	3	5	7	15
2	Mangangan II	5	3	9					
3	Alag	6	4	8					
4	Alag Bridge	6	4	9					
5	Sta. Cruz	6	4	10					
6	Malapad	6	4	9					
7	Lumangbayan	6	5	7					
8	River Delta	7	3	9					
Overall		**6**							



Biochemical oxygen demand refers to the amount of dissolved oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic conditions at a specified temperature. The BOD of a waterbody determines the impact of decaying matter on species in an ecosystem.

Based on the graph above, the highest recorded biochemical oxygen demand concentration occurred on August 16 sampling, having BOD concentration of 8.625 mg/L. Relative to dissolved oxygen concentrations, the BOD levels in all sampling stations also have small variation on its values. This illustrates that the relationship between BOD and dissolved oxygen concentration is inversely proportional. Overall, Alag-Malaylay River System has an average BOD concentration of 5.89 mg/L which meets the WQG for Class C and D for freshwater within DAO 2016-08.

5. Temperature

The most common physical assessment of water quality is the measurement of temperature. Temperature impacts both the chemical and biological characteristics of surface water. It affects the dissolved oxygen level in the water, photosynthesis of aquatic plants, metabolic rates of aquatic organisms, and the sensitivity of these organisms to pollution, parasites and disease.

Thermal pollution is the introduction of water that is warmer than the body of water into which it flows. It generally occurs near power plants. In other non-industrial areas, urban runoff is the main source of thermal pollution. This is water that has been heated as it flowed over parking lots, streets and sidewalks. Plowing near streams or the removal of the forest canopy during construction also contributes to thermal pollution by decreasing shade, thereby increasing solar heating of the water's surface. In addition to increasing the amount of solar radiation reaching the water's surface, removal of vegetation near streams often results in increased erosion and increased amounts of sediments in the water. The sediments absorb heat from sunlight rather than reflect it. This heats the water further. Warm water is less capable of holding dissolved oxygen. For this reason, temperature should be measured at the same place within the marine water at which dissolved oxygen is measured. This allows the correlation between the two parameters to be observed.

The problem of low dissolved oxygen levels is magnified by the fact that the metabolic rates of aquatic plants increase as water temperature rises, thus increasing their biochemical oxygen demand. Low dissolved oxygen levels leave aquatic organisms in a weakened physical state and more susceptible to disease, parasites, and other pollutants.

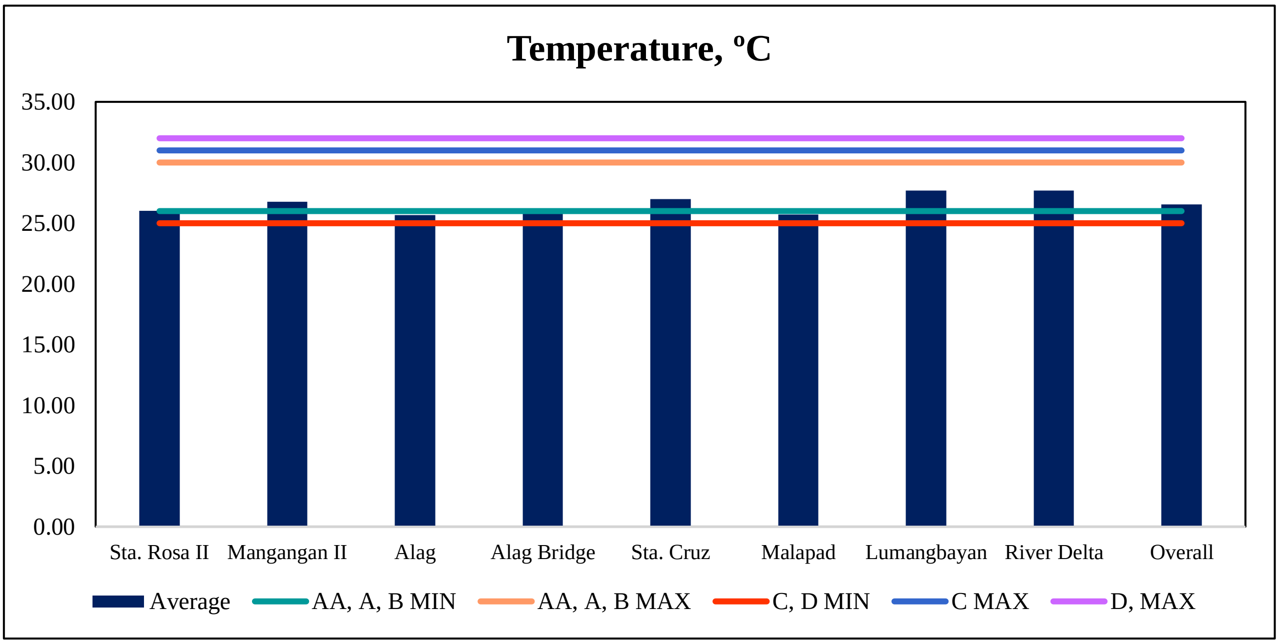
Table 5: Results for Temperature, °C

Station Identification	April 12, 2021	May 10, 2021	June 17, 2021	July 05, 2021	July 26, 2021
Sta. Rosa II	25.33	25.45	27.70	27.2	24.5
Mangangan II	26.11	26.25	29.00	28.1	24.6
Alag	25.08	24.28	26.50	27.8	24.2
Alag Bridge	25.39	25.02	26.80	27.8	24.1
Sta. Cruz	27.05	25.46	27.50	27.6	24.7
Malapad	25.1	23.78	26.80	26.6	24.6
Lumangbayan	27.1	27.35	28.90	28.8	24.6
River Delta	27.49	27.58	29.50	29.7	25
Overall	**26.08**	**25.65**	**27.84**	**27.95**	**24.54**

Station Identification	August 16, 2021	September 06, 2021	September 27, 2021	October 11, 2021
Sta. Rosa II	25.6	26.4	27.4	24.80
Mangangan II	26.5	26.7	28.5	25.20
Alag	25	25.2	25.7	27.10
Alag Bridge	24.9	25.2	26.0	27.00
Sta. Cruz	26.4	25.9	29.7	28.40
Malapad	25.3	25.4	26.5	27.20
Lumangbayan	28.3	26.6	29.7	27.70
River Delta	27.1	28.1	27.9	26.90
Overall	**26.14**	**26.19**	**27.7**	**26.79**

<table>
<tr><th rowspan="2">Station Number</th><th rowspan="2">Station Identification</th><th rowspan="2">Average Temperature</th><th rowspan="2">Min</th><th rowspan="2">Max</th><th colspan="5">Water Quality Guidelines
DAO 08 s. 2016</th></tr>
<tr><th>AA</th><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>1</td><td>Sta. Rosa II</td><td>26.04</td><td>24.50</td><td>27.70</td><td rowspan="3">26 – 30</td><td rowspan="3">26 – 30</td><td rowspan="3">26 – 30</td><td rowspan="3">25 – 31</td><td rowspan="3">25 - 32</td></tr>
<tr><td>2</td><td>Mangangan II</td><td>26.77</td><td>24.60</td><td>29.00</td></tr>
<tr><td>3</td><td>Alag</td><td>25.65</td><td>24.20</td><td>27.80</td></tr>
</table>

4	Alag Bridge	25.80	24.10	27.80					
5	Sta. Cruz	26.97	24.70	29.70					
6	Malapad	25.70	23.78	27.20					
7	Lumangbayan	27.67	24.60	29.70					
8	River Delta	27.70	25.00	29.70					
Overall		**26.54**							



Temperature is a crucial factor that affects the other water quality parameters. Turbidity, amount of sunlight, and thermal pollution have direct impact to the increase and decrease of temperature. As water temperature increases, the conductivity of water also increases, where TDS in water is directly related to conductivity. For each 1°C increment, conductivity rise by 2–4%. Temperature influences conductivity by increasing ions mobility and additionally the dissolvability of many salts and minerals.

Based on the graph above, the average temperature of all the sampling stations in Alag-Malaylay River System has shown small discrepancy in their values. Temperature of the water influences the metabolism of aquatic animals. An increase in temperature will cause an increase in the rate of respiration for the majority of aquatic species, which will result in a high consumption of oxygen. This indicates low dissolved oxygen concentration. Overall, the river system has an average temperature of 26.54 °C, which is within the acceptable range of temperature in all five categories of classification for freshwater based on DENR AO 2016-08.

6. Total Suspended Solids (TSS)

Total Suspended Solids (TSS) is a measure of concentration of all suspended particles obtained by separating these particles from a water sample using a filter. However, TSS cannot pass through a sieve of two micrometers and yet are indefinitely suspended in solution.

Suspended solids can result from erosion from urban runoff and agricultural land, industrial wastes, bank erosion, bottom feeders, algae growth or wastewater discharges. As levels of TSS increase, a water body begins to lose its ability to support a diversity of aquatic life. Suspended solids absorb heat from sunlight, which increases water temperature and subsequently decreases levels of dissolved oxygen (warmer water holds less oxygen than cooler water). Some cold water species, such as trout and stoneflies, are especially sensitive to changes in dissolved oxygen. Photosynthesis also decreases, since less light penetrates the water. As less oxygen is produced by plants and algae, there is a further drop in dissolved oxygen levels.

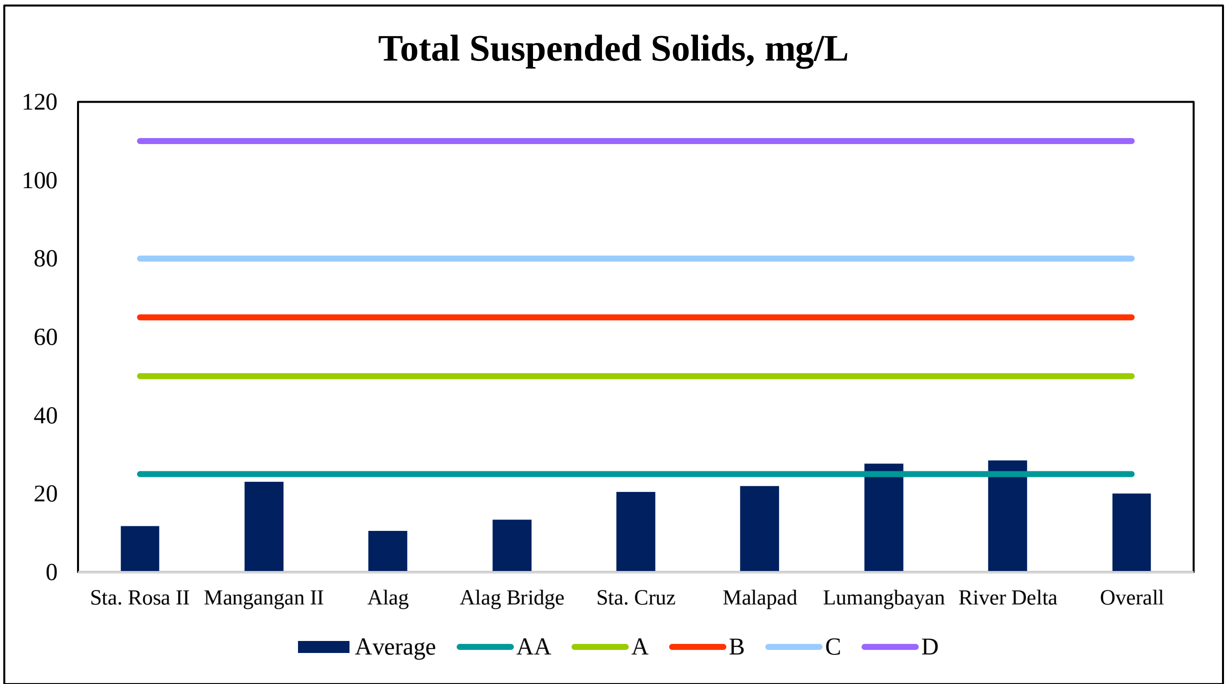
TSS can also destroy fish habitat because suspended solids settle to the bottom and can eventually blanket the riverbed. Suspended solids can smother the eggs of fish and aquatic insects and can suffocate newly hatched insect larvae. Suspended solids can also harm fish directly by clogging gills, reducing growth rates, and lowering resistance to disease. Changes to the aquatic environment may result in a diminished food source, and increased difficulties in finding food. Natural movements and migrations of aquatic populations may be disrupted.

Table 6: Results for Total Suspended Solids, mg/L

Station Identification	April 12, 2021	May 10, 2021	June 17, 2021	July 05, 2021	July 26, 2021
Sta. Rosa II	6	6	7	3	6
Mangangan II	106	6	5	3	4
Alag	6	9	9	5	9
Alag Bridge	8	12	4	6	7
Sta. Cruz	4	7	12	7	5
Malapad	5	16	9	9	4
Lumangbayan	4	24	8	6	4
River Delta	4	27	6	12	6
Overall	**5**	**13**	**8**	**6**	**6**

Station Identification	August 16, 2021	September 06, 2021	September 27, 2021	October 11, 2021	November 12, 2021
Sta. Rosa II	6	2	13	2	3
Mangangan II	4	3	7	2	<2
Alag	6	21	8	4	4
Alag Bridge	6	20	9	9	10
Sta. Cruz	5	24	14	12	2
Malapad	4	14	8	18	26
Lumangbayan	7	10	8	89	4
River Delta	6	28	8	17	16
Overall	**6**	**15**	**9**	**19**	**8**

Station Number	Station Identification	Average	Min	Max	Water Quality Guidelines DAO 08 s. 2016				
					AA	A	B	C	D
1	Sta. Rosa II	12	2	75	25	50	65	80	110
2	Mangangan II	23	2	206					
3	Alag	11	4	35					
4	Alag Bridge	13	4	56					
5	Sta. Cruz	20	2	133					
6	Malapad	22	4	129					
7	Lumangbayan	28	4	140					
8	River Delta	29	4	184					
Overall		**20**							



Total suspended solids refer to the particles present in waters. These suspended particles can come from soil erosion, runoff, discharges, stirred bottom sediments or algal blooms. High turbidity usually equates to high total suspended solids concentration. Elevated suspended particles have many impacts including making rivers look muddy, affecting aesthetics and swimming. Sediment carries nutrients, pesticides and other chemicals into the river that may impact fish and wildlife species. Sedimentation can restrict the areas where fish spawn, limit biological diversity and keep river water cloudy, reducing potential for the growth of healthy aquatic plants.

Based on the graph above, the average total suspended solids concentration in the stations of Lumangbayan and River Delta has slight increment compared to other stations. These stations are situated in the downstream part of the river, with high concentration of households. Aside from inorganic materials, organic particles resulted from decomposition of materials can also influence the concentration of total suspended solids. Surface runoff from the residential areas, introduces organic particles and sediments influencing the clarity of the water. Overall, the average total suspended solids concentration of the river system is 10 mg/L which meets the WQG for all the five categories of classification of freshwater body.

7. Phosphates (PO_4)

Phosphorus in small quantities is essential for plant growth and metabolic reactions in animals and plants. It is the nutrient in shortest supply in most fresh waters, with even small amounts causing significant plant growth and having a large effect on the aquatic ecosystem. Phosphate-induced algal blooms may initially increase dissolved oxygen via photosynthesis, but after these blooms die more oxygen is consumed by bacteria aiding their decomposition.

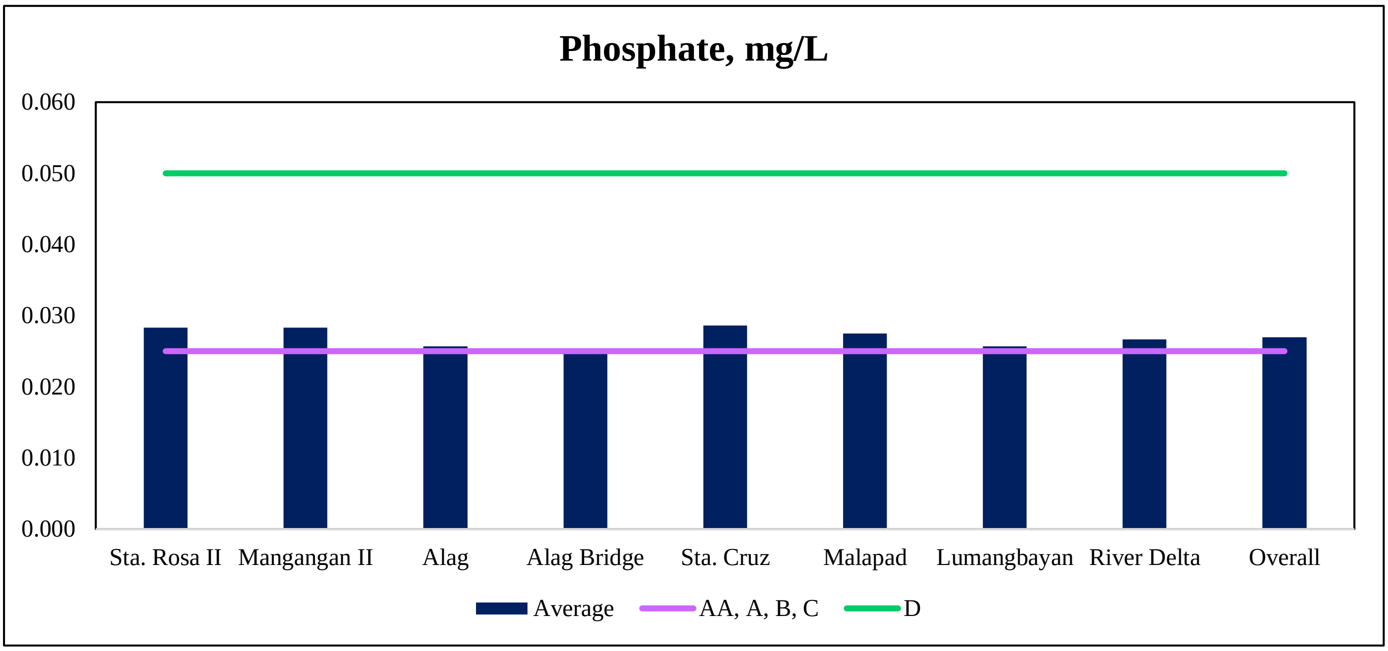
This may cause a change in the types of plants which live in an ecosystem. Sources of phosphate include animal wastes, sewage, detergent, fertilizer, disturbed land, and road salts used in the winter. Phosphates do not pose a human or health risk except in very high concentrations. It is measured in mg/L. The natural background of seawater for P as phosphate is 0.1mg/L. Higher concentration than 0.1mg/L may pose risk to aquatic ecosystem.

Table 7: Results of Phosphates, mg/L

Station Identification	April 12, 2021	May 10, 2021	June 17, 2021	July 05, 2021	July 26, 2021
Sta. Rosa II	0.02	0.02	0.020	0.02	0.03
Mangangan II	0.03	0.02	0.020	0.03	0.02
Alag	0.02	0.02	0.020	0.02	0.03
Alag Bridge	0.03	0.02	0.020	0.02	0.02
Sta. Cruz	0.03	0.02	0.030	0.03	0.03
Malapad	0.03	0.03	0.030	0.03	0.03
Lumangbayan	0.03	0.02	0.030	0.03	0.03
River Delta	0.03	0.03	0.030	0.02	0.02
Overall	**0.028**	**0.023**	**0.025**	**0.03**	**0.03**

Station Identification	August 16, 2021	September 06, 2021	September 27, 2021	October 11, 2021
Sta. Rosa II	<0.02	<0.02	0.060	<0.02
Mangangan II	<0.02	<0.02	0.050	<0.02
Alag	0.02	<0.02	0.050	<0.02
Alag Bridge	<0.02	<0.02	0.040	<0.02
Sta. Cruz	0.02	<0.02	0.040	<0.02
Malapad	0.03	0.020	0.020	<0.02
Lumangbayan	0.02	0.020	<0.02	<0.02
River Delta	<0.02	0.030	<0.02	<0.02
Overall	**0.021**	**0.021**	**0.037**	**<0.02**

Station Number	Station Identification	Average Phosphates	Min	Max	Water Quality Guidelines DAO 19 s. 2021				
					AA	**A**	**B**	**C**	**D**
1	Sta. Rosa II	0.028	0.020	0.060					
2	Mangangan II	0.028	0.020	0.050					
3	Alag	0.026	0.020	0.050					
4	Alag Bridge	0.025	0.020	0.040					
5	Sta. Cruz	0.029	0.020	0.040	0.025	0.025	0.025	0.025	0.05
6	Malapad	0.028	0.020	0.030					
7	Lumangbayan	0.026	0.020	0.030					
8	River Delta	0.027	0.020	0.030					
Overall		**0.027**							



Phosphorus is one of the nutrients necessary for plants, planktons, and animals. High phosphate levels can come from man-made sources such as septic systems, fertilizer runoff and improperly treated wastewater. The phosphates enter the water as the result of surface run-off and bank erosion. High concentration of phosphates and nitrates may cause eutrophication in any waterbody. Phosphates concentration greater than 0.5mg/L and nitrate concentration greater than 3mg/L may induced macroalgal bloom.

Based on the graph above, the average phosphate concentration of all stations only has minimal differences. The average concentration of phosphate in Alag-Malaylay River System is 0.25 mg/L, which is also the borderline value of phosphate in the water quality guidelines of DAO 2016-08. According to the conducted public consultation, some parts of the river are being used for laundry by the residents. Phosphate is the common ingredient in laundry detergents to soften the hard water. Overall, the average phosphate concentration is within the acceptable range for all waterbody classification for freshwaters.

8. Nitrate

Nitrogen is abundant on earth, making up about 80% of our air as N_2 gas. Most plants cannot use it in this form. However, blue-green algae and legumes have the ability to convert N_2 gas into nitrate (NO_3^-), which can be used by plants. Plants use nitrate to build protein, and animals that eat plants also use organic nitrogen to build protein. When plants and animals die or excrete waste, this nitrogen is released into the environment as NH_4^+ (ammonium). This ammonium is eventually oxidized by bacteria into nitrite (NO_2^-) and then into nitrate. In this form it is relatively common in freshwater aquatic ecosystems. Nitrate thus enters streams from natural sources like decomposing plants and animal waste as well as human sources like sewage or fertilizer.

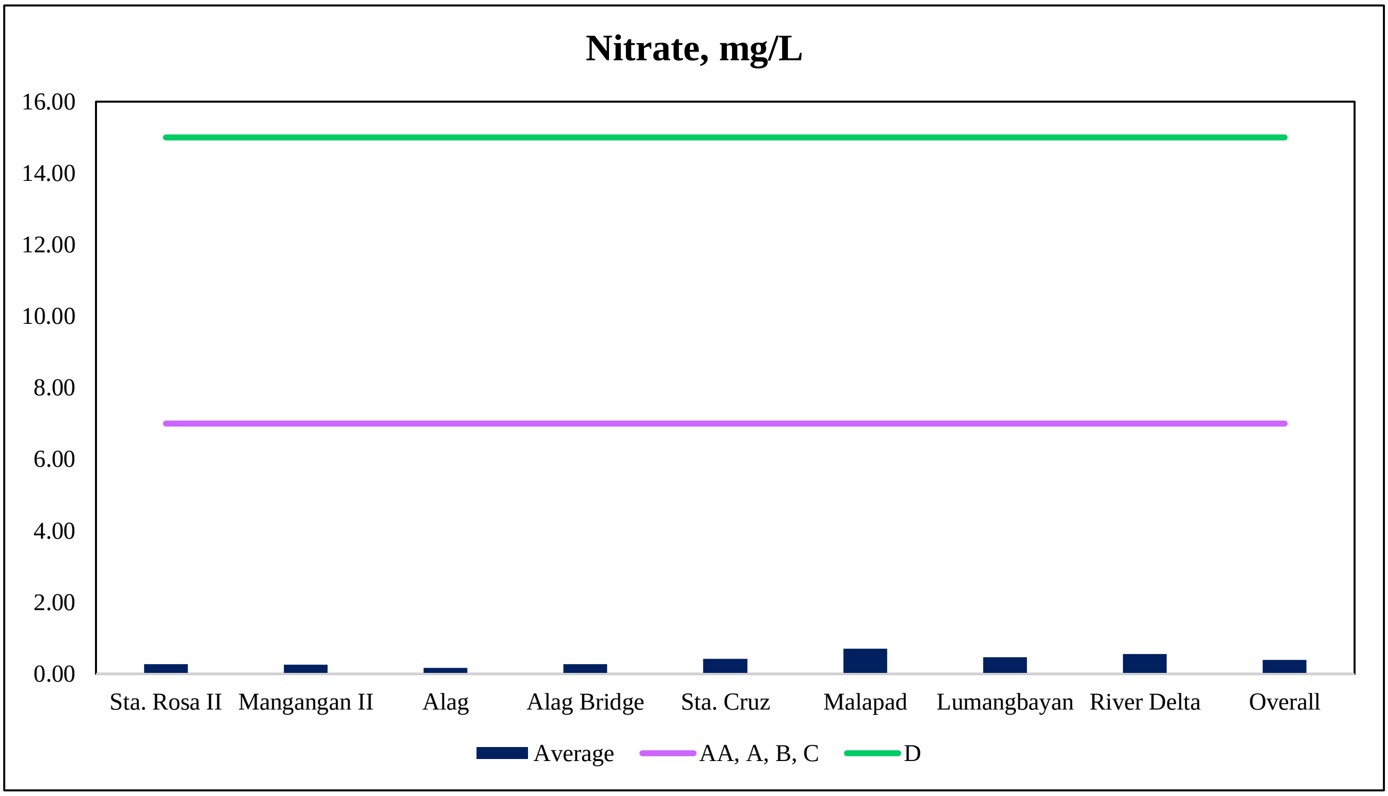
Nitrate is measured in mg/L. Natural levels of nitrate in seawater are usually 0.7 mg/L. Concentrations over 10 mg/L will have an effect on the freshwater aquatic environment. For a sensitive fish such as salmon the recommended concentration is 0.06 mg/L. Water with low dissolved oxygen may slow the rate at which ammonium is converted to nitrite (NO_2^-) and finally nitrate (NO_3^-). Nitrite and ammonium are far more toxic than nitrate to aquatic life.

Table 8. Results for Nitrate

Station Identification	**April 12, 2021**	**May 10, 2021**	**June 17, 2021**	**July 05, 2021**	**July 26, 2021**	**August 16, 2021**
Sta. Rosa II	0.90	0.27	<1	<1	<1	<1
Mangangan II	0.90	0.26	<1	<1	<1	<1
Alag	0.90	0.17	<1	<1	<1	<1
Alag Bridge	0.90	0.28	<1	<1	<1	<1
Sta. Cruz	0.90	0.42	<1	<1	<1	<1
Malapad	0.90	0.71	<1	<1	<1	<1
Lumangbayan	0.90	0.47	<1	<1	<1	<1
River Delta	0.90	0.56	<1	<1	<1	<1
Overall	**0.90**	**0.393**	**<1**	**<1**	**<1**	**<1**

Station Identification	September 06, 2021	September 27, 2021	October 11, 2021	November 12, 2021	November 26, 2021
Sta. Rosa II	<1	<1	<1	<1	<1
Mangangan II	<1	<1	<1	<1	<1
Alag	<1	<1	<1	<1	<1
Alag Bridge	<1	<1	<1	<1	<1
Sta. Cruz	<1	<1	<1	<1	<1
Malapad	<1	<1	<1	<1	<1
Lumangbayan	<1	<1	<1	<1	<1
River Delta	<1	<1	<1	<1	<1
Overall	**<1**	**<1**	**<1**	**<1**	**<1**

Station Number	Station Identification	Average Nitrate	Min	Max	Water Quality Guidelines DAO 08 s. 2016				
					AA	A	B	C	D
1	Sta. Rosa II	0.27	Generally, no Min and Max values since the recorded values are all <1		7	7	7	7	15
2	Mangangan II	0.26							
3	Alag	0.17							
4	Alag Bridge	0.28							
5	Sta. Cruz	0.42							
6	Malapad	0.71							
7	Lumangbayan	0.47							
8	River Delta	0.56							
Overall		**0.85**							



Excess levels of nitrates in water can create conditions that make it difficult for aquatic insects or fish to survive. A bay or estuary that has the milky colour of pea soup is showing the result of high concentrations of algae. Large amounts of algae can cause extreme fluctuations in dissolved oxygen. Photosynthesis by algae and other plants can generate oxygen during the day. However, at night, dissolved oxygen may decrease to very low levels as a result of large numbers of oxygen consuming bacteria feeding on dead or decaying algae and other plants.

The amount of nitrate in the water is what limits how much plants and algae can grow. Excess plants in a body of water can create many problems. An excess in the growth of plants and algae create an unstable amount of dissolved oxygen.

Illustrated on the graph above, the measured average nitrate concentration of the river is 0.85 mg/L. There is a minimal fluctuation in the average concentration of nitrates in all the stations. Nitrates are naturally occurring, and the natural concentration of nitrates in surface water is generally less than 1 mg/L. Compared to other nutrients such as phosphates, it dissolves more readily in water. Overall, the average concentration of nitrates in Alag-Malaylay River System is lower than the set WQG, hence the nitrate concentration of the river meets the required values for all the categories of freshwater classification in DAO 2016-08.

9. Fecal Coliform

Coliforms are bacteria that are always present in the digestive tracts of animals, including humans, and are found in their wastes. They are also found in plant and soil material. Fecal coliforms are the group of the total coliforms that are considered to be present specifically in the gut and feces of warm-blooded animals. Because the origins of fecal coliforms are more specific than the origins of the more general total coliform group of bacteria, fecal coliforms are considered a more accurate indication of animal or human waste than the total coliforms. The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals.

Table 9. Results for Fecal Coliform

Station Identification	April 12, 2021	May 10, 2021	June 17, 2021	July 05, 2021	July 26, 2021	August 16, 2021
Sta. Rosa II	170	21,000	230	130	170	78
Mangangan II	330	28,000	700	490	240	330
Alag	2,300	7,900	170	130	350	230
Alag Bridge	24,000	1,300	230	230	350	230
Sta. Cruz	3,500	15,000	330	170	350	490
Malapad	3,300	24,000	490	330	1,600	790
Lumangbayan	7,000	2,300	17,000	24,000	13,000	790
River Delta	24,000	2,300	490	790	1,300	2,400
Overall	**2,967**	**7,631**	**551**	**461**	**683**	**422**

Station Identification	September 06, 2021	September 27, 2021	October 11, 2021	November 12, 2021	November 26, 2021
Sta. Rosa II	230	45	78	16,000	460
Mangangan II	330	490	1,300	24,000	1,700

Alag	230	330	1,300	16,000	5,400
Alag Bridge	330	490	790	24,000	2,400
Sta. Cruz	490	330	2,400	24,000	16,000
Malapad	330	1,300	1,300	24,000	16,000
Lumangbayan	9,200	3,500	1,700	9,200	5,400
River Delta	5,400	490	790	9,200	16,000
Overall	**681**	**476**	**902**	**17,064**	**4,665**

Station Number	Station Identification	Geometric Mean Fecal Coliform	Min	Max	Water Quality Guidelines DAO 19 s. 2021				
					AA	**A**	**B**	**C**	**D**
1	Sta. Rosa II	219	45	21,000	20	50	100	200	400
2	Mangangan II	721	240	28,000					
3	Alag	528	130	7,900					
4	Alag Bridge	636	230	24,000					
5	Sta. Cruz	834	170	15,000					
6	Malapad	1,277	330	24,000					
7	Lumangbayan	5,367	790	24,000					
8	River Delta	1,731	490	24,000					
Overall		**922**							

Fecal coliform bacteria can enter rivers through direct discharge of waste from mammals and birds, from agricultural and storm runoff, and from human sewage. However, their presence may also be the result of plant material, and pulp or paper mill effluent.

Based on the graph above, Alag-Malaylay River System has a fecal coliform geomean of 922 MPN/100mL. The highest fecal concentration was measured on Lumangbayan, and River Delta. These respective areas have concentrated residentials.

Furthermore, based on the public consultation conducted these stations have high concentration of backyard piggery. The presence of fecal coliform in aquatic environment may indicate that the water has been contaminated with the fecal material of humans or other animals. Presence of feces in water can cause waterborne diseases and can skin infection and irritation. From the conducted public consultation, the residents experience itchiness due to the direct contact to the river. Overall, Alag-Malaylay River System failed to meet the WQG for fecal coliform concentration in all five categories for freshwater body classification.

VI. Recommendations

The summary of result of the water quality monitoring for one (1) year are as follows:

Parameters	Average/Geomean
Color	5 color units
pH	8.08
Temperature	26.54 °C
Dissolved Oxygen	7.51 mg/L
Biochemical Oxygen Demand	6 mg/L
Total Suspended Solids	20 mg/L
Phosphates	0.27 mg/L
Nitrates	0.39 mg/L
Fecal Coliform	922 MPN/100mL

Based on the laboratory results, EMB MIMAROPA proposed that the Alag-Malaylay River System will have Class C classification. Based on DAO 2016-08, *Class C* 1) Fishery Water for the propagation and growth of fish and other aquatic resources. 2) Recreational Water Class II – For boating, fishing, or similar activities. 3) For agriculture, irrigation, and livestock watering. A Public Consultation was held last 28 April 2022 to solicit the advice and suggestion of the general public. The said public consultation was attended by MENRO of El Nido, CENRO-Socorro, barangay officials and PEMU Oriental Mindoro personnel. The water quality and proposal were discussed.

It was raised that during the public consultation barangay officials and personnel from the MENRO discussed that they plan to use as recreational areas in the stations of Sta Rosa II and Mangangan II. With this, they requested to have a class B classification in these stations.

The final proposed classification of Alag-Malaylay River System is class B for the following stations: Mangangan II and Sta. Rosa II. The intended beneficial uses of

Class B waters based on DAO 2016-08 are: **Recreational Water Class I** – Intended for primary contact recreation (bathing, swimming, etc.)

While for stations: Alag, Alag Bridge, Sta. Cruz, Malapad, Lumangbayan, and River Delta, the final proposed classification is Class C. The intended beneficial uses of Class C waters based on DAO 2016-08 are: **Fishery Water** for the propagation and growth of fish and other aquatic resources. **Recreational Water Class II** – For boating, fishing, or similar activities. For agriculture, irrigation, and livestock watering.

Hereby are the recommendations for efficient management of Alag-Malaylay River:

1) An information, education, and communication (IEC) campaign should be implemented by Environmental Management Bureau – MIMAROPA, to disseminate the results and findings of the sampling activities among the Local Government units (LGUs), Non-Governmental Organization (NGOs) and the concerned local communities. This is to make them aware of the situation and identify for themselves the necessary steps/actions in achieving a sustainable river management for Alag-Malaylay River with the assistance from Environmental Management Bureau – MIMAROPA Regional Office.
2) Conduct of clean-up activities in partnership with EMB, NGAs, LGU, NGOs, private sectors and local communities.
3) Conduct of tree planting activities along the riverbanks, upland, coastal and mangrove areas. Especially to the areas near the dam.
4) Strict implementation of RA 9003 or Ecological Solid Waste Management Act.
5) Periodic monitoring of water quality and baseline monitoring on the levels of mercury present in the river as a result of unregulated small scale mining activities.
6) The LGU should strictly monitor the illegal mining operations within their area of jurisdiction.
7) The LGU should have a plan in the construction of a centralized wastewater treatment facility for the urban areas of the municipality.

VII. Annexes and Attachments

1. Photo Documentation of Activities
2. Data Monitoring Sheet
3. Minutes of the Public Consultation
4. Pollution Load Data

Prepared by:

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Head, Ambient Water Monitoring

Noted By:

MAEVELYN KATHRYN D. TUPASI
OIC, Ambient Monitoring and Technical Services Section

Attested by:

ENGR. PABLITO M. ESTORQUE JR.
Chief, Environmental Monitoring and Enforcement Division

Approved by:

JOE AMIL M. SALINO
Regional Director

Digitally signed by EMB MIMAROPA REGION OFFICE OF THE REGIONAL DIRECTOR
Date: 2022.12.20 09:41:48 +08'00'

PHOTOS TAKEN DURING SAMPLING ACTIVITIES	
	
	
PHOTOS DURING PUBLIC CONSULTATION CONDUCTED	
	

Minutes of the Public Hearing on Waterbody Classification of Alag-Malaylay River System

Date: 28 April 2022
Starting Time: 1028H
Venue: Baco Municipal Covered Court, Baco, Oriental Mindoro
Attendance: Ederlita Labre, Karl Alexander Dammay, Adz Hazen Dimapilis, Carlotta Levinia Jugno, Deunise Angelo Abu, Ma. Kimberly Evora, Officials in MENRO Baco, and Barangay Officials.

Agenda: Waterbody Classification of Alag-Malaylay River System

I. Registration of Attendance

II. Opening Prayer was led by Ms. Ma. Kimberly B. Evora, EMED Staff of EMB MIMAROPA Region.

III. Presentation of Water quality data and Proposed Classification for Alag-Malaylay River was conducted by Mr. Karl Alexander Dammay.
   - Discussion of the Significance and Objectives of the Classification of Waterbody
   - Methodology of the Classification
   - DAO 2016-08: Water Quality Guidelines and General Effluent Standards of 2016
   - Classification of Waterbodies within the MIMAROPA Region

IV. Discussion of Water Quality Results CY 2021 of Alag-Malaylay River
   - Presentation of the water quality results from different sampling stations for each primary parameters such as Dissolved Oxygen, Biochemical Oxygen Demand, Total Suspended Solids, Phosphates, Nitrates, Color, Chlorides, pH, Temperature, and Fecal Coliform.
   - The limiting concentration for each parameter in accordance with each waterbody classification was also illustrated to further shows the applicable classification for the said river based on the findings.

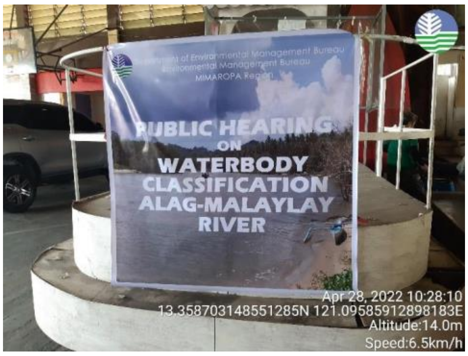
V. Open Forum/Discussion

- Discussion on the possible reasons of high concentration of parameters such as nitrates, phosphates, and fecal coliform in the certain areas of the river.
- A participant asked for conducting further studies regarding the said river to devise mitigation measures to maintain its current water quality.
- EMB proposed to designate Alag-Malaylay River as Class “C” based on the presented laboratory results.
- The intended beneficial usage for Class “C” waterbody was discussed as well as the objective on the maintaining and improving the current water quality.
- A participant suggested to classify the parts of Sta. Rosa II and Mangangan II as Class “B” for recreational purposes such as swimming.
- Concerns such as itchiness due to direct contact to the river and small-scale mining in the area as well as the effect of mercury in the body was also discussed.

- All the participants agreed on proposing the stations of Mangangan II and Sta. Rosa II as Class “B” and the rest of the parts as Class “C”.

VI. End of Public Hearing
• Provision of Snacks on the Attendees and Photo Documentations.
End Time:1107H

PHOTOS DURING THE PUBLIC HEARING ON WATERBODY CLASSIFICATION OF ALAG-MALAYLAY RIVER SYSTEM
28 April 2022 at Baco Municipal Covered Court, Baco, Oriental Mindoro



Public Hearing on Waterbody Classification Alag-Malaylay River

Discussion regarding the classification and laboratory results of Alag-Malaylay River

Open forum regarding the classifications of the river and concerns in the area

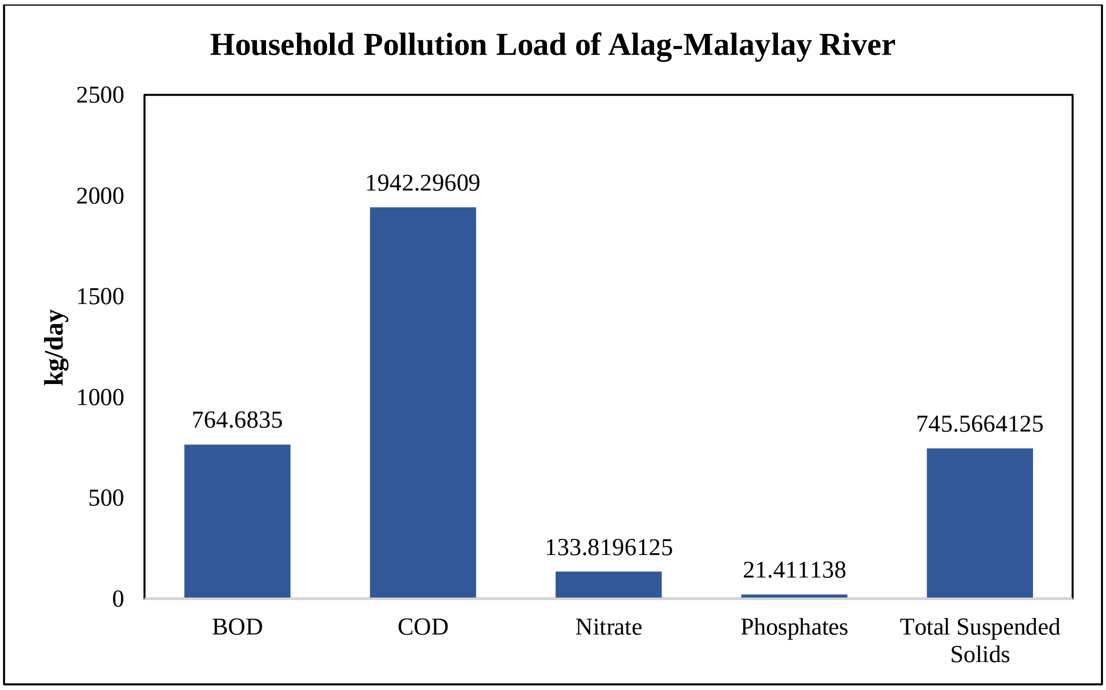
Closing of the Meeting

Pollution Load Data

Alag-Malaylay River is encompasses two (2) municipalities in Oriental Mindoro. It stretches form the border of San Teodoro to Baco until it drains towards the nearest bay. In line with the effective management and protection of the Philippines' water resources, EMB Memorandum Circular No. 2020-25 where mandated to estimate the total pollution load of freshwater bodies in relation to its assimilative capacity. According to the EMB ME 2020-25, Pollution Load is the "*amount or quantity of a pollutant parameter being discharged by the facility"* and sources of pollution are mainly from domestic, industrial/commercial, surface runoff, solid waste, backyard livestock, poultry, and fisheries.

Household/Domestic Source

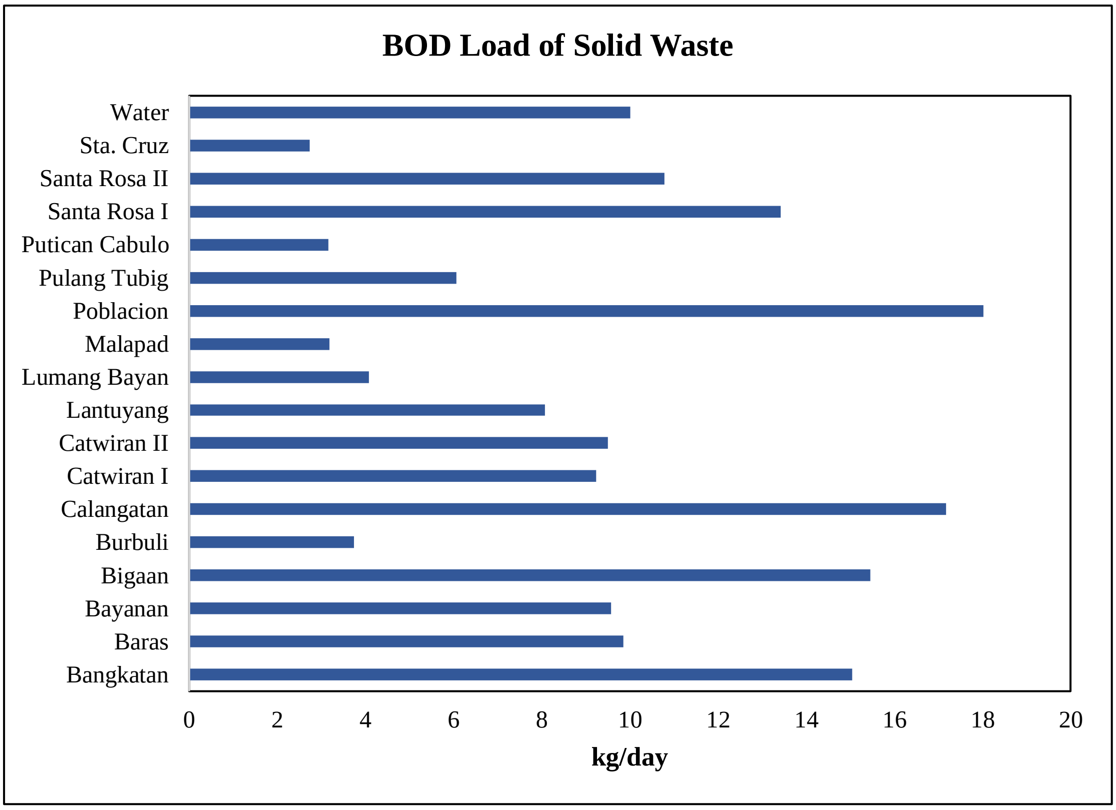
The significant parameters considered in the estimation of the pollution load for households are the Biochemical Oxygen Demand (BOD), the Chemical Oxygen Demand (COD), the Nitrate, the Phosphate, the Total Suspended Solids (TSS), and the Fecal Coliform. There was a total of eighteen (18) barangays considered in the computation, with a population of 26,831.



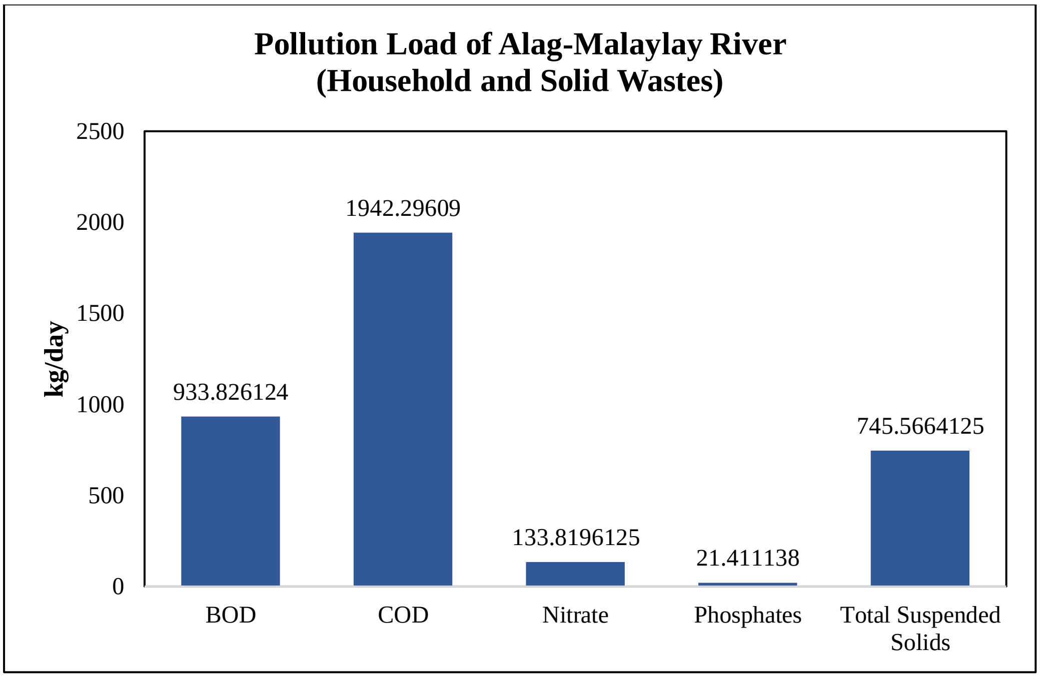
Based on the given graph, it is given that the chemical oxygen demand is typically higher than the rest of the parameters. A high concentration of COD in water indicates the presence of a substantial amount of oxidizable organic material, and consequently a low level of dissolved oxygen. Organic pollution can reduce amounts of dissolved oxygen, which has been shown to be detrimental to aquatic organisms. While naturally occurring nitrates and phosphates were projected to have the lowest concentration.

Solid Waste Source

Similar to the domestic pollution load, the BOD loading of solid waste is predicated on the population within the scope of the area. Assuming that the average per capita generation rate is 0.40 kg, according to the National Solid Waste Status Report 2014, the estimated BOD load per barangays is illustrated on the graph below.



Pollution Load from Household and Solid Waste



In addition of BOD load from the solid waste, the estimated BOD load increase from 764.68 kg/day to 933.83 kg/day. However, the COD concentration is still highest among the other parameters. High concentrations of COD and BOD indicate considerable oxygen depletion, which reduces the amount of oxygen available to aquatic organisms.