ABONGAN RIVER

CLASSIFICATION REPORT

CY 2018

Department of Environment and Natural Resources
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I. Executive Summary

Philippines is an archipelago surrounded by different bodies of water. The country is considered as one of the most biodiverse country in Asia. Its marine and fresh water is the most diverse resource of the country.

Water is the most abundant resource of the planet. This resource is needed in everyday activities. Only three percent of the total ground water resource can be actually use in drinking. Due to various usage of water, it is the most threatened resource in the planet. Everyday water quality decline continuously, because of lack of environmental awareness of humans. Continuous water quality monitoring is done to ensure that a body of water complies on specified standards. But only few understand the value of conservation and protection of this valuable resource.

Environmental scientists around the world work tirelessly to conserve, protect and preserve this valuable resource. New effective methods on water quality monitoring were established to help the government implement their environmental laws and policies. They also work on new technologies that can help reduce and mitigate the negative impacts of human activities in a water body.

In the Philippines, the National Government, LGUs, and private sectors work together to educate people about the relevance and effects of human activities in water quality. Hence, the Republic Act 9275 otherwise known as "Philippine Clean Water Act" was enacted by the Congress. It is stated that the characteristics of water which define its use in terms of physical, chemical, biological, bacteriological or radiological characteristics by which the acceptability of the water is evaluated. It aims to assess, monitor and classify water bodies of the country, and create policies to improve the existing quality of water. It also aims to increase the environmental awareness of every individual in the country.

Different water quality has different impact on humans, animals and environment. For an instance, sufficient concentration of phosphate and nitrate is good for irrigation and aquaculture but not for drinking. Another example is that high

concentration of coliform in water can cause disease and illness to living organisms, and has poor water quality in terms of biological property. Measurement of biological, chemical and physical properties determines the quality and classification of body of water. A good water quality can sustain its beneficial use and a poor water quality cannot sustain its beneficial use.

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 water quality monitoring was done every quarter for a period of one year. This is stipulated in the Volume 1 of the Water Quality Monitoring Manual of DENR EMB. This was done to collect data on its current use in order to determine its most beneficial usage. Among the data collected are the following, to wit: history of the water body, tributaries, susceptibility to soil erosion and flooding, existing human activities, and water quality monitoring supported by onsite and laboratory analyses.

The parameters that were monitored are the following; temperature, total suspended solids, dissolved oxygen, pH, nitrate and phosphate. The downstream of the river has the highest concentration of TSS in all stations. Temperature and pH is within the acceptable range for class C water in all stations. The downstream part of the river has the lowest DO with a value of 4.14 mg/L. Normally, the part of the river with low DO is a wetland with low gradient and low stream flow. In the case of Abongan River, the station at Brgy. Pinagupitan is a wetland area with mangroves. This justifies its low concentration of dissolved oxygen.

With this, the proposed classification for Abongan River is **Class C** for the whole stretch of the river. The intended beneficial uses of **Class C** waters based on DAO 2016-08 are as follows:

a. ***Fishery Water*** *for the propagation and growth of fish and other aquatic resources*
b. ***Recreational Water Class II*** *– for boating, fishing or similar activities;* ***and***
c. ***For agriculture, irrigation and livestock watering***

II. Brief Introduction

The Municipality of Taytay is a first class municipality of Palawan, located at northern part of Palawan Island. It is subdivided in 31 barangay namely; Abongan, Banbanan, Bantulan, Batas, Bato, Beton, Busy Bees, Calawag, Casian, Cataban, Debangan, Dipla, Limangcong, Meytegued, New Guinto, Old Guinto, Pamantalon, Pancol, Paly (Paly Island), Poblacion, Pularacuen (Canique), San Jose, Sandoval, Silanga, Alacalian, Baras (Pangpang), Libertad, Minapla, Talog, Tumbod and Paglaum. 10 of these are considered protected area barangays. The municipality is also part of the El Nido-Taytay Managed Resource Protected Area (ENTMRPA). Three (3) barangays of Taytay and 18 barangays of El Nido were declared as part of the said protected area. The said proclamation was based from Proclamation No. 32 dated October 8, 1998.

It has a total land area of 139,050 hectares. Taytay is the largest municipality in Palawan in terms of land area. Taytay's topography features flat plains to rolling mountainous ranges. About 63% of the municipality has an elevation of 0-100 meters; succeeded by 100-200 meters with a percentage distribution of 26%. The highest elevation of Taytay is 900-979 meters.

According to 2015 census, it has an estimated population of 70,165. Agriculture is one of the major sources of livelihood of the residents of the municipality. Over 25% of the total land area is used for agriculture. Fishing also is prominent source of livelihood, Taytay is considered as one of the top producing municipality in terms of fisheries. Livestock and poultry are practiced in the backyard of most residents.

Barangay Abongan is one of the 31 barangays in the municipality of Taytay. It has the largest land area of protected areas and considered as the largest barangay in terms of land area.

Historical Background

The name of the town of Taytay was derived from the word "Talaytayan". According to the local folklore, the first Spaniards who came to the town asked the natives about the name of the place while gesturing to the cluster of arranged pieces of

wood and bamboo that was serving as a bridge. The natives mistook the gestures as referring to the bridge, thus answered them with the word "Talaytayan". It was recorded as the name of the place, which was altered through time and became "Taytay" until present time .

Before the Spanish colonization, the Kingdom of Taytay was ruled by a monarch. The crew of Magellan held the Taytay king and queen captive to get ransom. They intended to secure supplies before they go to Mollucas. The king and queen subjects complied with the demands of the foreigners; according to the notes of Antonio Pigafetta.

The town was founded by the Spaniards in 1623 and the government of Taytay was officially established in 1662 by Count San Agustin. It was the Capital town of Calamianes, what we now know Palawan.

Fort Sta. Isabel or Fuerza de Sta. Isabel was constructed from 1667 to December 1738. It was named after Queen Isabel II of Spain. The fort was constructed through polo y servicio under the reign of Gobernadorcillo Jose Tierra de Salcedo. It constructed to ward of Moro pirates that time. In 1721, an infamous attack on Taytay was led by Datu Segutillo aided by 3,880 Moro pirates. An entire barrio was wiped out and the town was under siege. After 21 days, the pirates fled the town and were not seen after. In 1818 Calamianes was divided into two provinces; Castilla in the north and Asturias in the south. The capital town of Calamianes is Taytay and the capital town of Asturias is Puerto Princesa. In 1873, the capital of Castilla was transferred to Cuyo.

During American regime the municipal boundaries was reduced approximately by 500,000 hectares due to the creation of the Municipality of El Nido. On September 1924 Governor Wood visited the municipality and found the condition of Fort Sta. Isabel unkempt he gave P100.00 to the Municipal President Vicente Baculi to clear the fort.

On November 11, 1942, troops of the Japanese Imperial Army landed at Taytay and established a garrison at the municipal building compound. By April 3, 1944, Taytay was under the Japanese control, but attack from guerrilla snipers continued to keep the Japanese soldiers wary. Due to continuous harassment by the Filipino guerrillas, led by then Captain Carlos Amores, Japanese rank badly reduced due to

heavy casualties. The majority of Japanese forces evacuated Taytay on October 1, 1944, while the last remnants of the enemy left Taytay on October 18, 1944 without accomplishing anything of note.

The first elected municipal mayor after the liberation was Agapito Calalin, who did not finish his term of office. The municipal government of Taytay is currently headed by Mayor Romy L. Salvame.

Abongan River

Abongan River is a stream and is located in Province of Palawan, Philippines. The estimate terrain elevation above sea level is 5 meters. The river passes to the West Philippine Sea. The river has branches to different areas. The upstream of the river runs from the forest-covered mountain of Barangay Abongan. Little activity are done in the area since it is near to a protected area of the barangay, agriculture and controlled logging were practiced in the area. The midstream of the river is located near the vast agricultural land of Barangay Abongan. The major use of the river is for irrigation of agricultural land especially in the midstream. It discharges its water to Abongan Bay.

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 Abongan River 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 three (3) monitoring stations were established each representing the upstream, midstream and downstream part of the river.

Samples were collected using grab sampling method last March 15, June 25, August 28 and October 10 of CY 2018. 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 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."

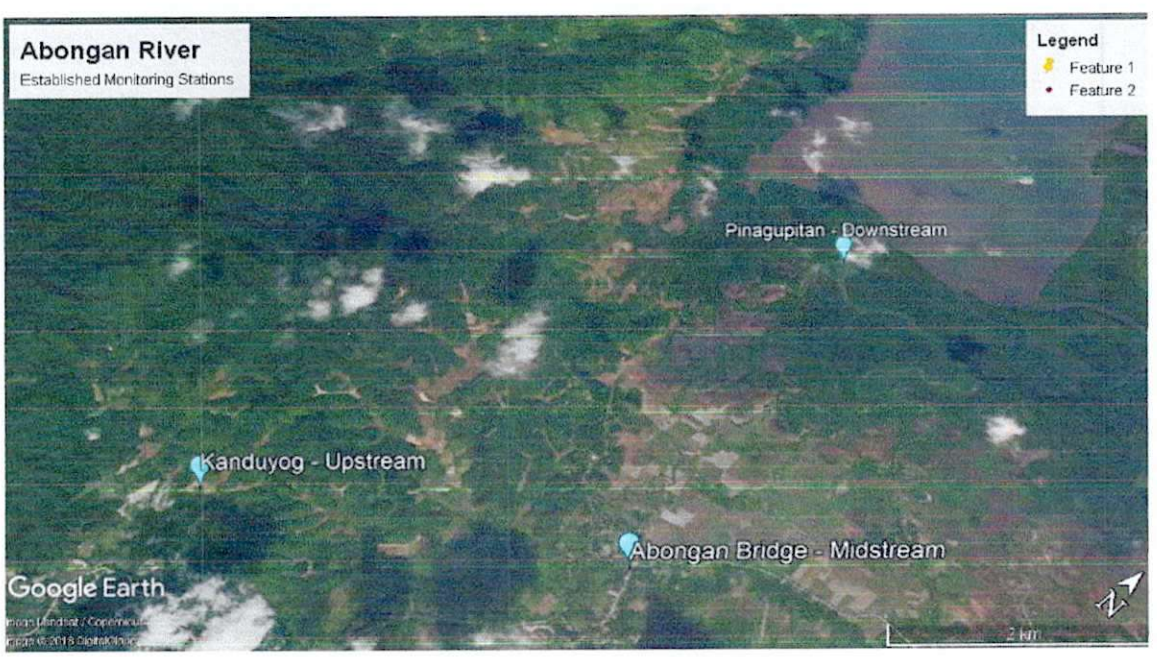
Secondary data was acquired from local government unit and other national government agencies concern. Interviews with local residents, barangay officials and stakeholders were conducted to gather pertinent information on the actual and potential

beneficial usage of Abongan River. In-situ and laboratory results data were presented through public consultation. Final classification report will be submitted to EMB Central Office for final evaluation, approval and publication.

The three (3) established monitoring stations with its corresponding GPS coordinates are presented on the succeeding section. The coordinates were plotted using Google Earth to map the whole stretch of Abongan River.

WATER QUALITY MONITORING STATIONS

Station No.	Station Identification	GPS Coordinates North	GPS Coordinates East
1	Kanduyog (Upstream)	10° 40' 45" N	119° 27' 18" E
2	Abongan Bridge (Midstream)	10° 42' 59" N	119° 26' 44" E
3	Pinagupitan (Downstream)	10° 39' 32" N	119° 25' 40" E



Google Earth Plot of the Established Monitoring Stations of Abongan River

V. Results and Discussion

Parameters Monitored With Corresponding Analytical Data

The significant parameters for the water quality measurement of the water of Abongan River are pH, dissolved oxygen, temperature, total suspended solids, nitrates and phosphates. The results of both in-situ and laboratory analyses conducted during the four (4) sampling periods are presented in the succeeding sections.

1. 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 1: Results for pH

Station No.	Station Identification	1st	2nd	3rd	4th
1	Kanduyog (Upstream)	8.14	7.38	7.85	7.18
2	Abongan Bridge (Midstream)	7.62	7.68	6.40	8.10
3	Pinagupitan (Downstream)	6.62	7.03	6.74	7.83
	Overall	7.46	7.36	7.00	7.70

2. 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 2: Results for Dissolved Oxygen, mg/L

Station No.	Station Identification	1st	2nd	3rd	4th
1	Kanduyog (Upstream)	7.75	5.47	6.42	6.21
2	Abongan Bridge (Midstream)	6.68	6.30	5.97	5.80

3	Pinagupitan (Downstream)	5.30	4.64	3.01	3.60
	Overall	6.58	5.47	5.13	5.20

3. 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 stream 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 3: Results for Temperature, °C

Station No.	Station Identification	1st	2nd	3rd	4th
1	Kanduyog (Upstream)	26.77	26.99	28.56	28.06
2	Abongan Bridge (Midstream)	26.95	28.32	30.37	28.27
3	Pinagupitan (Downstream)	28.64	29.84	31.39	31.00
	Overall	27.45	28.38	29.11	29.11

4. 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 river bed. 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 sources, and increased difficulties in finding food. Natural movements and migrations of aquatic populations may be disrupted.

Table 4: Results for Total Suspended Solids, mg/L

Station No.	Station Identification	1st	2nd	3rd	4th
1	Kanduyog (Upstream)	10	34	14	28
2	Abongan Bridge (Midstream)	5	43	6	31
3	Pinagupitan (Downstream)	63	118	32	25
	Overall	26	65	17	28

5. 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 are usually less than 1 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 5: Results for Nitrates, mg/L

Station No.	Station Identification	2nd	3rd	4th
1	Kanduyog (Upstream)	0.16	0.15	0.10
2	Abongan Bridge (Midstream)	0.10	0.15	0.13
3	Pinagupitan (Downstream)	0.09	0.13	0.05
	Overall	0.12	0.14	0.09

6. Phosphate

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. Larger streams may react to phosphate only at levels approaching 0.1 mg/L, while small streams may react to levels of PO_4^{-3} at levels of 0.01 mg/L or less. In general, concentrations over 0.05 will likely have an impact while concentrations greater than 0.1 mg/L will certainly have impact on a river.

Table 6: Results of Phosphates, mg/L

Station No.	Station Identification	3rd	4th
1	Kanduyog (Upstream)	<0.007	<0.007
2	Abongan Bridge (Midstream)	<0.007	<0.007
3	Pinagupitan (Downstream)	<0.007	<0.007
	Overall	<0.007	<0.007

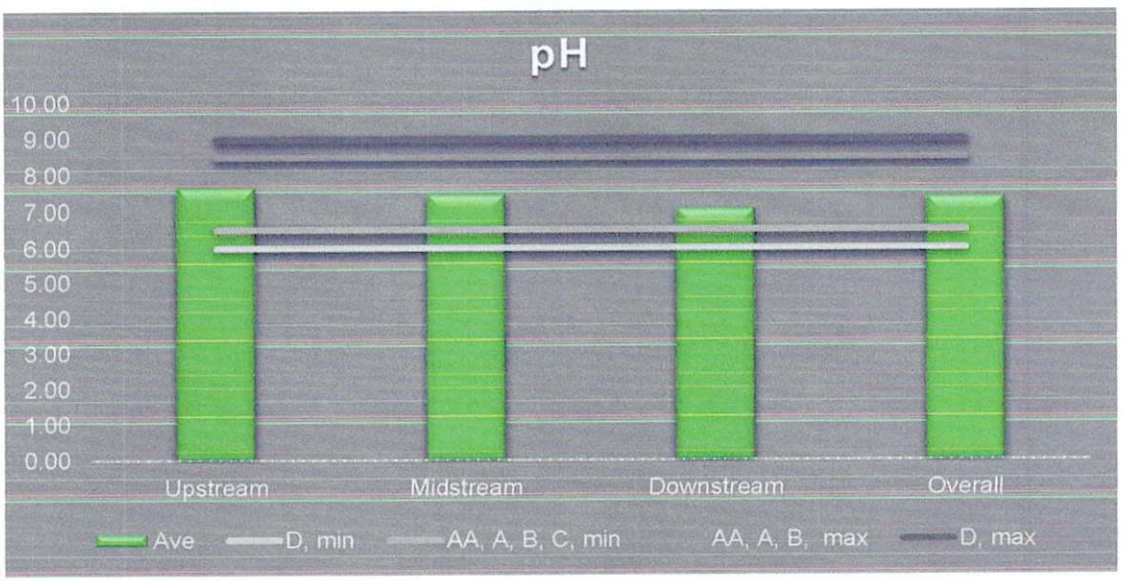
VI. Assessment of Results

The results of all the conducted physico – chemical analyses were consolidated and assessed. The average values of the four monitoring periods were compared to the 2016 Water Quality Guidelines as stipulated in the DAO 08 series of 2016. The assessment of each determined parameter is discussed in the succeeding sections.

pH

Table 7: pH

Station Number	Station Identification	Average	Water Quality Guidelines DAO 08 s. 2016				
			AA	A	B	C	D
1	Kanduyog (Upstream)	7.64	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 9.0	6.0 – 9.0
2	Abongan Bridge (Midstream)	7.45					
3	Pinagupitan (Downstream)	7.06					
	Overall	7.38					



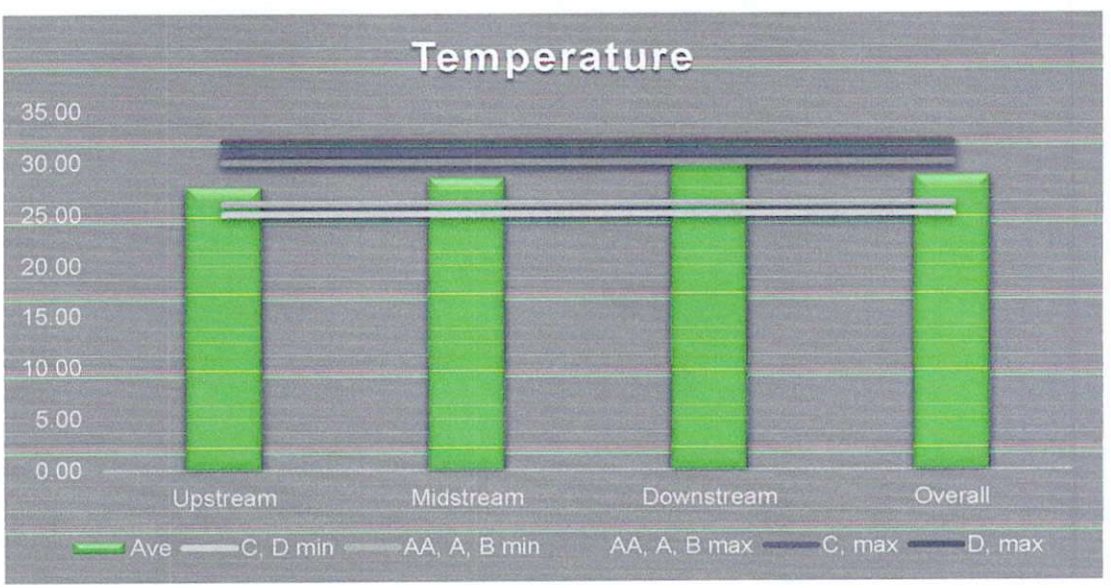
The optimum pH for river water is around 7.4. Acid rain causes the increase in the acidity of river. Extremes in pH can make a river inhospitable to life. Low pH is especially harmful to immature fish and insects. Acidic water also speeds the leaching of heavy metals harmful to fish. And it also creates an itchy feeling when in contact with human skin.

The river has an average of 7.38 pH units. It is a very favorable condition where aquatic organisms can thrive without stress. Based from the graph, the river fall within the acceptable range of water quality guidelines set forth by the DENR through DAO 2016-08 in all the five classifications of fresh surface waters.

Temperature

Table 8: Temperature, °C

Station Number	Station Identification	Average	Water Quality Guidelines DAO 08 s. 2016				
			AA	A	B	C	D
1	Kanduyog (Upstream)	27.60	26 – 30	26 – 30	26 – 30	25 – 31	25 - 32
2	Abongan Bridge (Midstream)	28.48					
3	Pinagupitan (Downstream)	30.22					
	Overall	28.76					



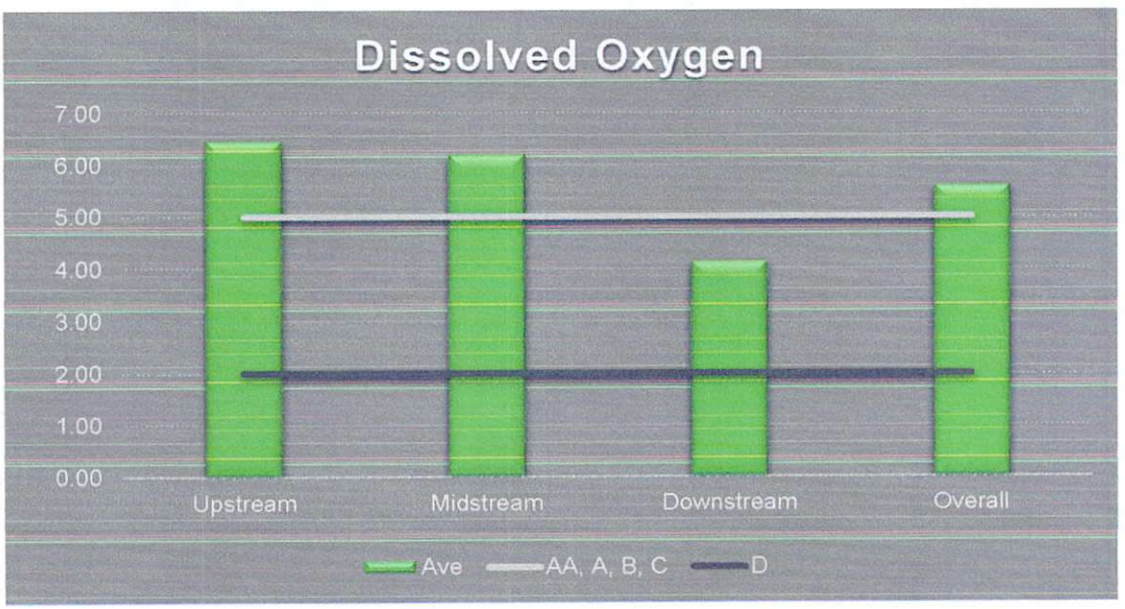
Temperature impacts the rates of metabolism and growth of aquatic organisms, rate of plants' photosynthesis and solubility of oxygen in river water. It also increases the sensitivity of organisms to disease, parasites and toxic materials. At a higher temperature, plants grow and die faster, leaving behind matter that requires oxygen for decomposition.

Based on the above graph, the river has an average temperature of 28.76 °C. Based on the graph, the river fall within the acceptable range of water quality guidelines set forth by the DENR through DAO 2016-08 in all the five classifications of fresh surface waters.

Dissolved Oxygen

Table 9: DO, mg/L

Station Number	Station Identification	Average	Water Quality Guidelines DAO 08 s. 2016				
			AA	A	B	C	D
1	Kanduyog (Upstream)	6.46	5	5	5	5	2
2	Abongan Bridge (Midstream)	6.19					
3	Pinagupitan (Downstream)	4.14					
Overall		5.60					



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.

Based by the graph, the average DO is 5.60 mg/L. It can be deduced that the downstream part of the river has the lowest DO with a value of 4.14 mg/L. This is quite low and it is an indicator of poor river quality. Normally, the part of the river with low DO such as this is a wetland with low gradient and low stream flow. In the case of Abongan River, the station at Brgy. Pinagupitan is a wetland area with mangroves. This justifies its low concentration of dissolved oxygen. Nevertheless, overall the river passed the water quality guidelines in all the five classifications for surface freshwater. These water quality guidelines for DO are set forth in the DENR AO 2016-08.

Total Suspended Solids

Table 10: TSS, mg/L

Station Number	Station Identification	Average	Water Quality Guidelines DAO 08 s. 2016				
			AA	A	B	C	D
1	Kanduyog (Upstream)	22	25	50	65	80	110
2	Abongan Bridge (Midstream)	21					
3	Pinagupitan (Downstream)	60					
Overall		34					

The transport of sediment is a natural function of rivers. Modification of the landscape has accelerated the rate of soil into waterways. 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.

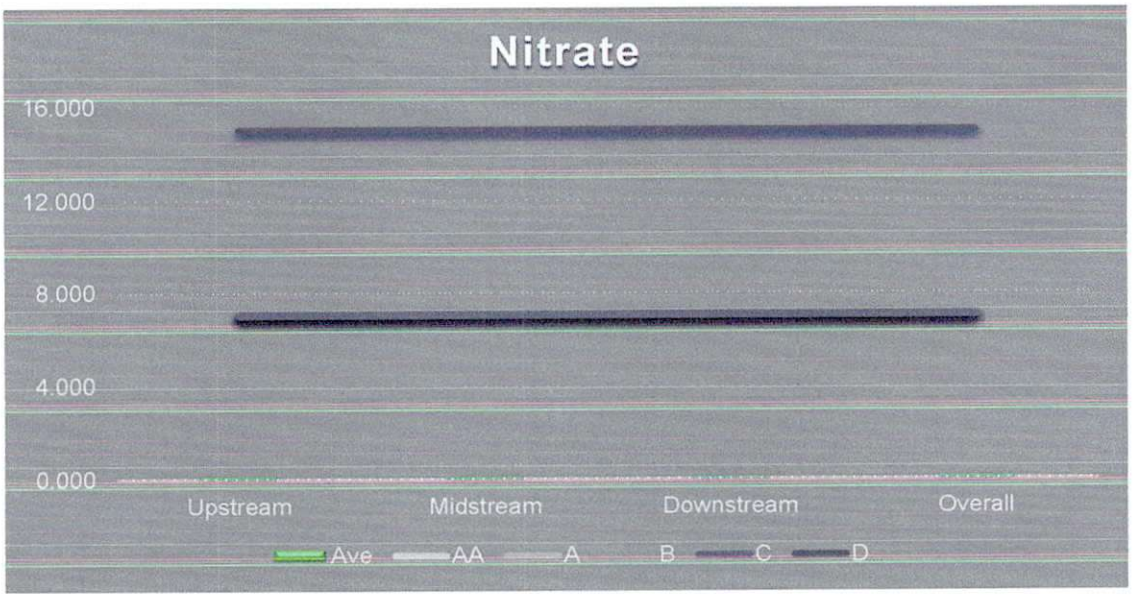
Abongan River recorded the highest TSS concentration at Pinagupitan with a value of 60 mg/L. The river is even prone to oils spills and leakages from the boats that are docked nearby. It also susceptible to bank erosion due to the uncontrolled cutting of vegetation near the river bank thus increasing the suspended solids in the water. Based on the erosion and flood hazard map of the municipality of Taytay, the area where Abongan River is located suffers from moderate erosion and flooding.

The average TSS for the whole river is 34 mg/L. Based on the water quality guidelines, the river passed the maximum limit for TSS concentration in all of the water body classification categories.

Nitrates

Table 11: NO_3, mg/L

Station Number	Station Identification	Average	Water Quality Guidelines DAO 08 s. 2016				
			AA	A	B	C	D
1	Kanduyog (Upstream)	0.137	7	7	7	7	15
2	Abongan Bridge (Midstream)	0.127					
3	Pinagupitan (Downstream)	0.090					
Overall		0.118					



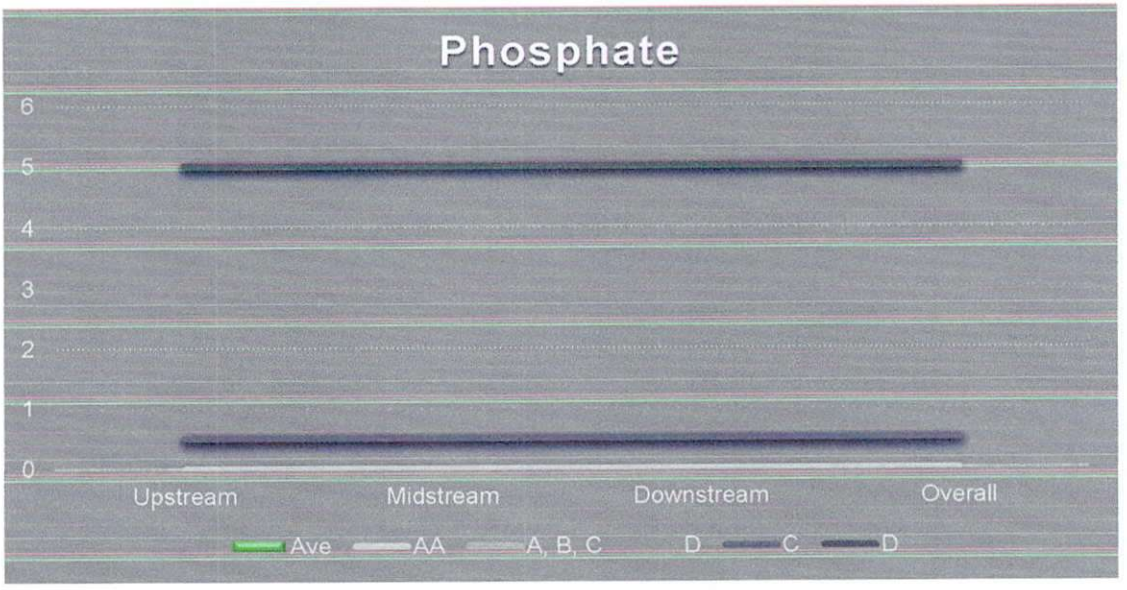
Unlike temperature and dissolved oxygen, the presence of normal levels of nitrates usually does not have a direct effect on aquatic insects or fish. However excess levels of nitrates in water can create conditions that make it difficult for aquatic insects or fish to survive. Algae and other plants use nitrates as a source of food.

Based on the graph presented, the levels of nitrates are way below the maximum set limit for all the classes of fresh surface waters. The average nitrates level of Abongan River is 0.118 mg/L.

Phosphates

Table 12: PO_4, mg/L

Station Number	Station Identification	Average	Water Quality Guidelines DAO 08 s. 2016				
			AA	A	B	C	D
1	Kanduyog (Upstream)	<0.007	<0.003	0.5	0.5	0.5	5
2	Abongan Bridge (Midstream)	<0.007					
3	Pinagupitan (Downstream)	<0.007					
Overall		<0.007					



Phosphates are essential for the growth of plants and animals but human activities have altered its natural cycle. The main sources are drainage from farmland particularly fertilizer and manure runoff and sewage effluent which contains dishwashing detergents, food and drink additives. Phosphate levels above 0.03 mg/L can encourage growth of algae in aquatic systems. High levels of phosphate can lead to overgrowth of plants, increased bacterial activity and decreased oxygen levels.

Based on the graph, the average phosphate concentration of Abongan River is <0.007 mg/L. This is a value below the maximum limits for all classes of freshwater. Therefore the river is still within the allowable range of phosphates in freshwaters.

VII. Recommendations

Results of water quality monitoring and all the data gathered were presented to the public to solicit their opinion for the most beneficial use of the waters of Abongan River. The said public hearing was conducted at the gymnasium of Brgy. Abongan in the Municipality of Taytay in Palawan. The attendees were composed of the members of the barangay local government unit of Abongan, the MENRO and the local residents particularly those living and benefiting from the waters of Abongan River.

During the public hearing, there were exchange of ideas and opinions on the current use of the river. It was revealed that the river has some few areas for quarrying; all of which are permitted by the local government. A local resident raised the issue on piggery wastewater being discharged to the river. The presence of backyard piggeries was acknowledged by the MENRO and the Barangay Council. It was then explained the impact of untreated wastewater from piggeries on the river particularly on its dissolved oxygen and suspended solids. The river will eventually lose its capacity to support life if untreated wastewater continues to drain towards the river. The need for a barangay ordinance was suggested to make the construction of a septic tank or lagoons imperative to every owner of a backyard piggery. In this way, the water quality of the river will be maintained to its most beneficial use. It also came to the knowledge of everybody that the river had been causing flood in the lower areas. This is due to the removal of vegetation at the river banks. Because of this, the barangay council will look for mitigating measures such as reforestation to arrest river bank soil erosion. The river runs along an agricultural area and it is susceptible to fertilizer runoffs. This is the cause of its turbidity. Although the river has been used for irrigation purposes, it was still suggested that redirecting the stream must be done with prudence so as not to disturb the ecosystem of the river.

Given these facts and supported by the results of the water quality monitoring performed, the proposed waterbody classification of the river is Class C. No objections were made. It was explained to them that the classification given to Abongan River will

help them control all man-initiated activities on and near the river. This will be basis of general effluent standards to be used for regulations. It was also emphasized that the objective of classification is not to hamper economic growth but to achieve ecological balance of the natural resource which everybody uses at present and for the next generations. The classification of the river will help the locality achieve sustainability. Thereafter, they unanimously agreed to assign a lower classification in the meantime. This is to give them ample time to look for mitigating measures and practices in order to come up with a good river management. Therefore, the proposed classification for the whole stretch of Abongan River is Class C. As stipulated in the new DENR AO 08 series of 2016, Fresh Surface Water classified as **Class C** is intended for the following: ***(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;* ***and*** (3) ***For agriculture, irrigation and livestock watering***

Therefore, 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 Abongan River with the assistance from Environmental Management Bureau – MIMAROPA Regional Office.

VIII. Annexes and Attachments

1. Photo Documentation of Activities
2. Laboratory Results of Water Sampling
3. Field Data of Water Sampling
4. Minutes of Public Hearing
5. Attendance Sheet of Public Hearing
6. ECAN Map of Taytay

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PHOTOS TAKEN DURING THE QUARTERLY MONITORING

PHOTOS TAKEN DURING THE
PUBLIC HEARING