APURAWAN RIVER

CY 2018

CLASSIFICATION REPORT

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I. Executive Summary

Constant water quality monitoring is the key to ecological sustainability of the largest resource of this planet. Water resource is what we need in our day to day activities. Most of us do not seem to care enough in the conservation and protection of this resource. From the moment we turn on the tap to fill the glass or go for a dip in the ocean or angling at a nearby lake or river, water satisfies our needs. Yet only a few of us knows and understands that this, too has its own needs in order to be sustainable.

Environmental scientists work tirelessly behind the scenes just to keep this resource healthy and can be used by the next generations. A wide range of different water quality monitoring techniques is used to measure the characteristics to ensure its most beneficial usage.

As we continue to build cities, convert farm lands to commercial areas, water quality monitoring becomes increasingly essential. The rivers and streams around the world have been diminishing due to lack of environmental awareness. The impacts of land-based activities are huge enough to cause chaos in the water systems, both above and below the ground.

The Republic Act no. 9275 or the Philippine Clean Water (CWA) of 2004 defines water quality as “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.

Different usages of water require different water quality. For instance, sufficient concentration of nitrogen, phosphorous and other micronutrients is good for irrigation water but not for drinking water. A water body that sustains its beneficial use has good water quality and a water body that does not sustain its beneficial uses has poor water quality. Measurement of water quality and classification provides important information about the integrity of a body of water. The most widely used method is the measurement of its physical, chemical and bacteriological constituents. The quality of water is measured or monitored to determine if conforming to the prescribed water quality for its intended usage.

Classification of water body is monitored quarterly for a period of one year. Other factors, such as existing use, social acceptability and the result of analyses are taken into account in deciding the appropriate classification of a water body or section of a water body.

With this, the proposed classification for Apurawan River is Class A for the upstream, Class B for the midstream and Class C for the downstream of the river. The intended beneficial uses of Class A, B, C waters based on DAO 2016-08 are as follows:

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
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

Aborlan is a 2nd class coastal municipality in the province of Palawan. It is located 69 kilometers south of Puerto Prinsesa City. The municipality is bounded by Puerto Princesa City in northeast, Sulu sea in the east, West Philippine Sea in the west, Municipality of Quezon in the southwest and Municipality of Narra in the southeast. Municipality of Aborlan is subdivided into 19 barangays namely; Apo-Arawan, Apoc-apoc, Aporawan, Barake, Cabigaan, Gogonan, Iraan, Isaub, Jose Rizal, Mabini, Magbabadil, Plaridel, Ramon Magsaysay, Sagpangan, San Juan, Tagpait, Tigman, Poblacion, Culandanum and Marikit.

The Municipality of Aborlan has a total land area of 276.6 sq. kms. It lies in a vast grassy plain in the east; the forest-covered Mount Aborlan divides the west coast and the east coast of the municipality. Malanao Island is located near the east coast of Aborlan mainland, which has a terrain elevation of 8 meters above sea level. Most of the municipality is located near the east coast and it is the known municipality with an agricultural college named Western Philippines University.

According to the 2015 census, it has a population of 35,091 people. Tagalog is their major language used in the municipality. Some people use Ilonggo, Cuyonon and Palawanon as their medium of communication. Roman Catholicism is the dominant religion among the inhabitants followed by Protestantism, several Baptist church, JIL, Dating Daan and Iglesia ni Cristo.

Apurawan, Aporawan or Apurauan is one of the barangays in the Municipal of Aborlan. It is located on the west coast of the municipality facing the West Philippine Sea. Most of the community is located near the coast and their livelihood greatly depends on fishing. Some residents practice agriculture in flat plain near the mountain and use Apurawan River as source of water for irrigation.

Historical Background

The town's name was either derived from "Abelnan", a legendary tree belonging to the gods who occupied the place. Another story is two men went fishing for the first time in the town and was frightened by the rise and fall of the tide, so they asked "Abenlan" from which came the name Aborlan. But the most popular is the story of one American who, standing in the midst of the forest, was amazed at the sight of so many wild boars that he exclaimed, "This is a boar land!". With passing of time, it was changed to Aborland and finally at present known Aborlan.

On June 28, 1949 Aborlan was converted into a municipality pursuant to Executive Order No. 232 under the presidency of Elpidio Quirino. In 1951 the barrios of Berong and Alfonso XII was transferred to the newly created town of Quezon. In 1910 Western Philippine University was established paving the way for scientific farming in Palawan.

Apurawan River

Apurawan River has an estimated elevation of 5 meters above sea level. It runs from the forest-covered mountain of Aborlan to the west coast of Barangay Apurawan. The upstream part of the river is from the forest-covered mountain of Mount Aborlan and passes through Brgy. Apurawan and discharges to the West Philippine Sea. The midstream portion of the river runs in a forest-covered plain. Logging and quarrying are the observed activity in this part of the stream that often results to bank erosion. Calategas River, a minor river, confluences with Apurawan River downstream before finally discharging to the West Philippine Sea. This stream could affect its water quality.

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 Apurawan 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 April 17, July 5, September 11 and October 22 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 Apurawan 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 Apurawan River.

WATER QUALITY MONITORING STATIONS

Station No.	Station Identification	GPS Coordinates North	GPS Coordinates East
1	Upstream	9° 34' 26" N	118° 23' 26" E
2	Midstream	9° 34' 27" N	118° 22' 12" E
3	Downstream	9° 36' 10" N	118° 20' 34" E

Google Earth Plot of the Established Monitoring Stations of Apurawan River

V. Results and Discussion

Parameters Monitored With Corresponding Analytical Data

The significant parameters for the water quality measurement of the water of Apurawan 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	Upstream	7.30	7.74	8.45	8.55
2	Midstream	8.10	8.26	8.35	8.51
3	Downstream	7.07	8.00	8.44	8.45
	Overall	7.49	8.00	8.41	8.50

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	Upstream	6.17	6.69	6.37	7.83
2	Midstream	6.49	7.48	6.92	7.59
3	Downstream	3.27	6.84	5.61	8.38
	Overall	5.31	7.00	6.30	7.93

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	Upstream	28.79	28.07	27.27	25
2	Midstream	29.72	28.46	27.92	24.88
3	Downstream	33.25	28.25	28.78	25.16
	Overall	30.59	28.26	27.99	25.01

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	Upstream	26	4	1	9
2	Midstream	11	3	<1	7
3	Downstream	9	11	<1	18
	Overall	15	6	1	11

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	Upstream	0.09	0.10	0.58
2	Midstream	0.1	0.11	0.10
3	Downstream	0.17	0.10	0.18
	Overall	0.12	0.10	0.29

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	1st	2nd	3rd	4th
1	Upstream	0.02	<0.007	<0.007	<0.007
2	Midstream	0.02	<0.007	<0.007	<0.007
3	Downstream	0.02	<0.007	<0.007	<0.007
	Overall	0.020	<0.007	<0.007	<0.007

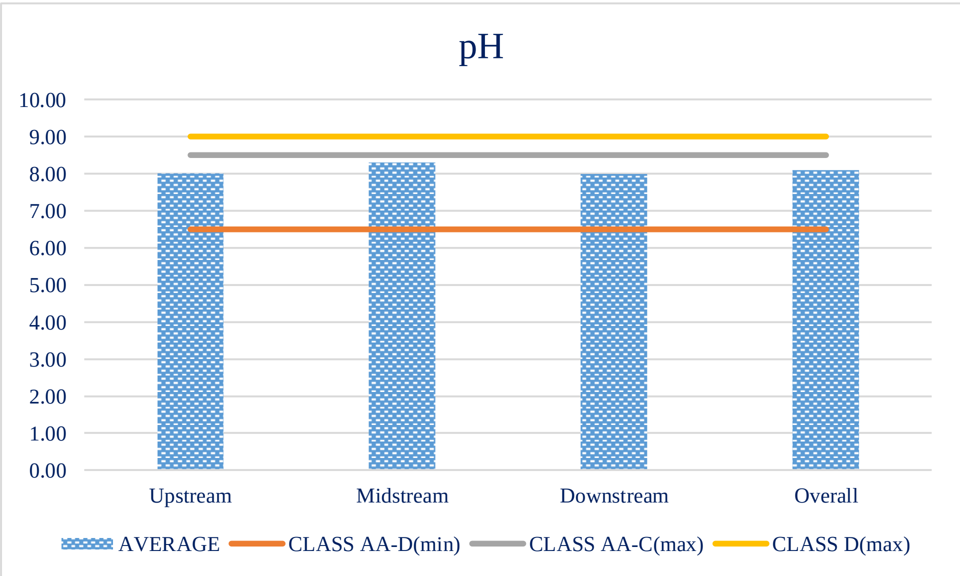
VI. Assessment of Results

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	Upstream	8.01	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5	6.5 – 9.0	6.0 – 9.0
2	Midstream	8.31					
3	Downstream	7.99					
	Overall	8.10					



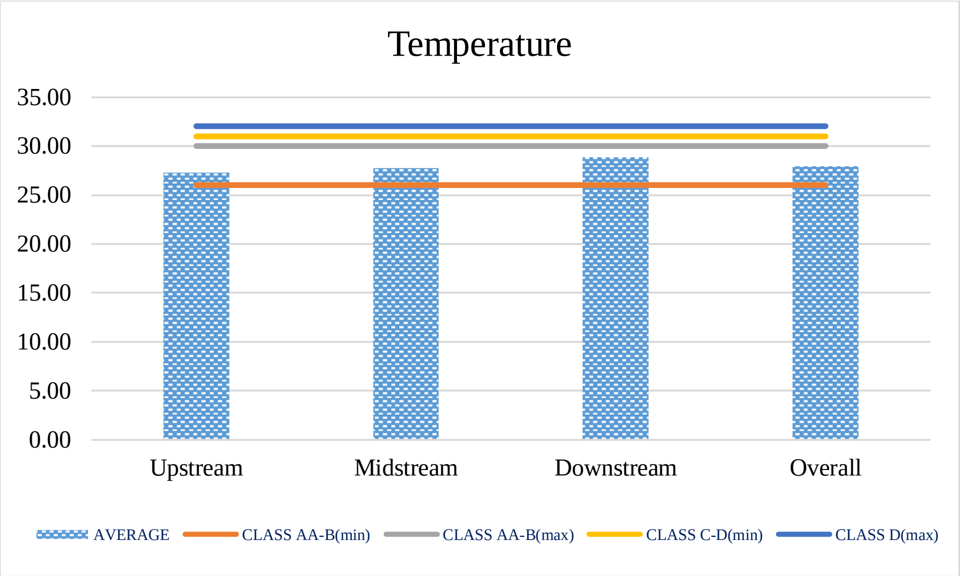
The optimum pH for river water is around 7.4. Acid rain causes the increase in the acidity of river. Extremes in pH can make a river inhospitable to life. Low pH is especially harmful to immature fish and insects. Acidic water also speeds the leaching of heavy metals harmful to fish.

The river has an average of 8.10 pH units. This value higher than the optimum pH for rivers and must be carefully monitored. A mini dam was constructed in the midstream of the river. Some parts river is currently being mined for its sand and gravel. Based on the facts given by the local government official, the sand and gravel taken from the river is solely used for the municipality that it serves. 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, ºC

Station Number	**Station Identification**	**Average**	**Water Quality Guidelines DAO 08 s. 2016**				
			AA	**A**	**B**	**C**	**D**
1	Upstream	27.28	26 – 30	26 – 30	26 – 30	25 – 31	25 - 32
2	Midstream	27.75					
3	Downstream	28.86					
	Overall	27.96					



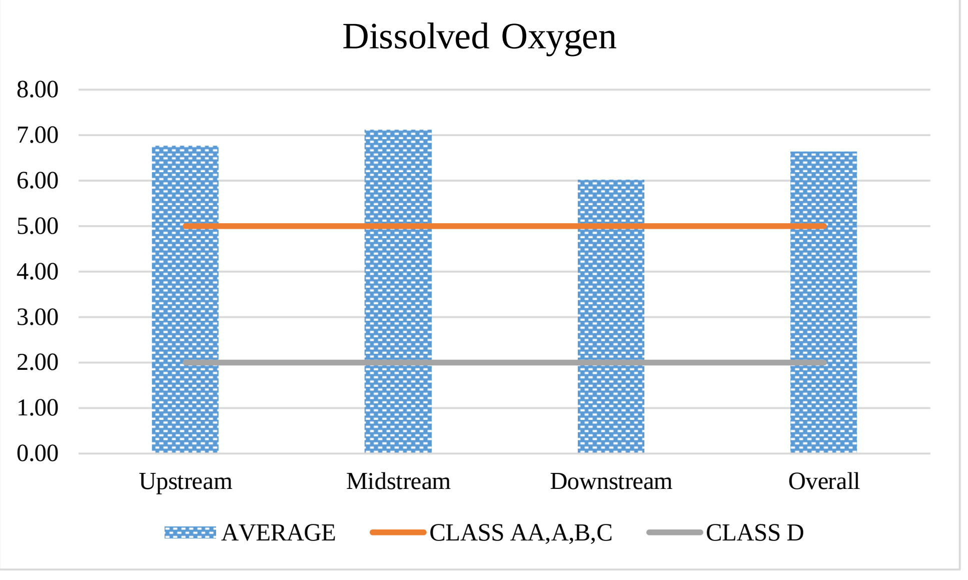
Temperature impacts the rates of metabolism and growth of aquatic organisms, rate of plants' photosynthesis, solubility of oxygen in river water and organisms' sensitivity to disease, parasites and toxic materials. At a higher temperature, plants grow and die faster, leaving behind matter that requires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

Based on the above graph, the river has an average temperature of 27.96 °C. 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.

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	Upstream	6.77	5	5	5	5	2
2	Midstream	7.12					
3	Downstream	6.03					
	Overall	6.64					



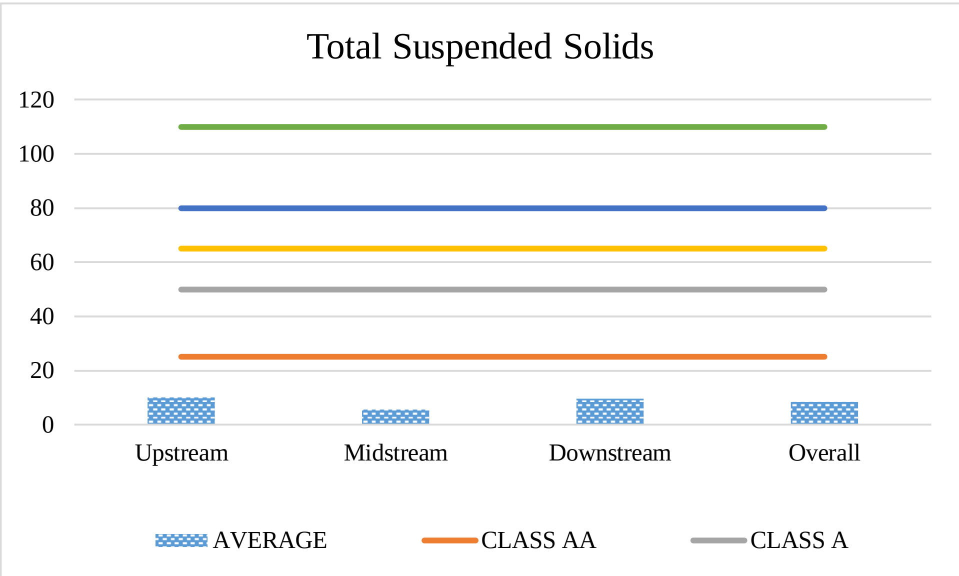
Adequate supply of dissolved oxygen gas is essential for the survival of aquatic organisms. A deficiency in this area is a sign of an unhealthy river. There are a variety of factors affecting levels of dissolved oxygen. The atmosphere is a major source of dissolved oxygen in river water. Waves and tumbling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

Based on the graph, the lowest DO was at midstream with an average value of 6.03 mg/L. On the other hand, the highest was at midstream with an average value of 7.12 mg/L where a mini dam is located. The average DO is 6.64 mg/L. The river passed the minimum DO requirement set for all five classifications. 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	Upstream	10	25	50	65	80	110
2	Midstream	5					
3	Downstream	10					
Overall		8					



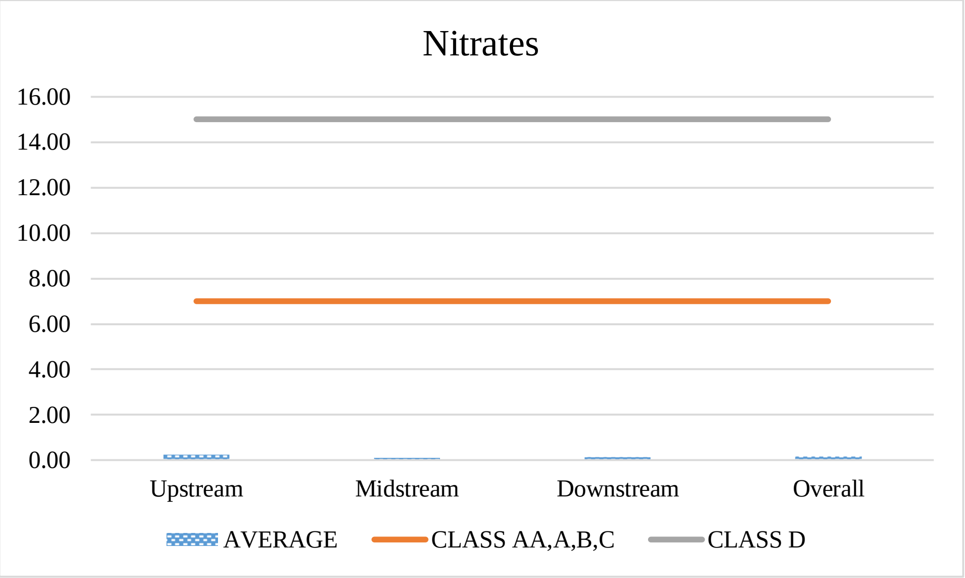
The transport of sediment is a natural function of rivers. Modification of the landscape has accelerated the rate of soil into waterways. Elevated suspended particles have many impacts including making rivers look muddy, affecting aesthetics and swimming. Sediment carries nutrients, pesticides and other 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.

The average TSS for the whole river is 8 mg/L. Based from 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	Upstream	0.257	7	7	7	7	15
2	Midstream	0.103					
3	Downstream	0.150					
	Overall	0.170					



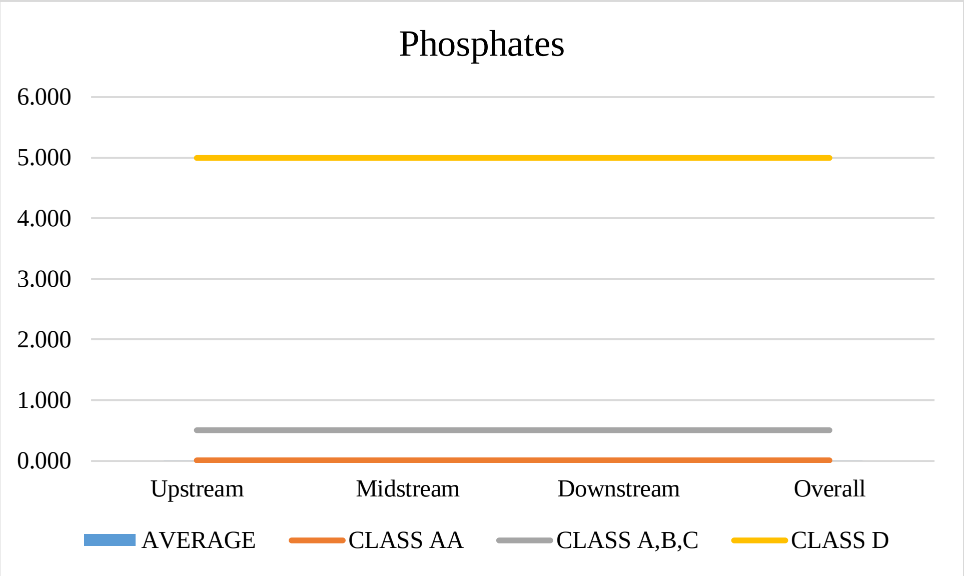
Unlike temperature and dissolved oxygen, the presence of normal levels of nitrates usually does not have a direct effect on aquatic insects or fish. However excess levels of nitrates in water can create conditions that make it difficult for aquatic insects or fish to survive. Algae and other plants use 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 Apurawan River is 0.170 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	Upstream	0.010	<0.003	0.5	0.5	0.5	5
2	Midstream	0.010					
3	Downstream	0.010					
Overall		0.010					



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 Apurawan River is 0.010 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 collected were presented to the public to solicit their opinion for the best usage of the waters of Apurawan River. The said public hearing was conducted at the Barangay Hall Apurawan Aborlan, Palawan last 29 November 2018. The attendees were composed of the Barangay Chairperson, Councilmen and staff from the office of the MENRO. The classification activity was presented to the barangay officials during their regular session.

Given these facts and supported by the results of the water quality monitoring performed, the proposed waterbody classification of the river is Class B for the upstream and midstream, while the proposed classification for downstream is Class C. Initially, the representatives of the local government were not amenable with the proposal because of their concern about the quarrying activities along Apurawan River. Officials of the barangay asked the effects of quarrying in the water quality of the river. The EMB discussed with them the pros and cons of choosing the classification. It was reiterated to them that the current use of the river could possibly worsen the water quality if the quarrying were not regulated well. Some parts of the river is currently being mined for its sand and gravel. There are large-scale extraction of streambed materials, mining and dredging below the existing streambed. The alteration of riverbed form and shape leads to several impacts such as erosion of channel bed and banks, increase in channel slope and change in channel morphology. These impacts may cause the undercutting and collapse of river banks and loss of adjacent land and structures. It can also lead to upstream erosion as a result of an increase in channel slope and changes in flow velocity. Another adverse impact is downstream erosion due to increased carrying capacity of the stream, downstream changes in patterns of deposition and changes in channel bed and habitat type.

There is an existing dam in the midstream part of the river. The Barangay Chairperson together with his officials wanted to protect and keep the river clean and preserve its good water quality especially in the upstream part of the river. They said that they will now limit the quarrying activities and control the permits. The upstream part is officially declared by the Palawan Council for Sustainable Development (PCSD) as Tribal and Ancestral Zone (PCSD Proclamation No. 18) and the area comprises of 1,700 hectares within Sitio Daan in Barangay Apurawan.

With these facts and after carefully analyzing the results of the discussions, both the DENR EMB MIMAROPA and Barangay Chairperson and Councilmen of Apurawan agreed to assign three different classifications for the stretch of Apurawan River. Class A was agreed to be assigned to the upstream part of the river. This is the area from Sitio Kinabubuan going up towards Mt Aborlan. Class B was assigned to the midstream part where most of the quarrying activities are done. For the downstream part, Class C was assigned until it drains to the West Philippine Sea. Since the monitoring data was presented during their regular session, this was approved and resolved by the Chair on Committee on Environment of the Local Government of Apurawan.

As stipulated in the new DENR AO 08 series of 2016, Fresh Surface Water classified as **Class A** is intended for ***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** is intended for ***Recreational Water Class I*** *– Intended for primary contact recreation (bathing, swimming, etc.) and* **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 Apurawan River with the assistance from Environmental Management Bureau – MIMAROPA Regional Office. Additionally, the local government is recommended to control the sand and gravel activities along the river. In this way, the sustainability of the ecosystem of the river will be attainable without sacrificing the needs and economic growth of the locality.

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. PCSD Proclaimed Tribal Ancestral Zone (TAZ)

Prepared by:

JANE T. DUMENDEN
EMS II original signed document

Reviewed by:

MAEVELYN KATHRYN D. TUPASI
OIC, Ambient Monitoring Section
original signed document

Attested by:

ENGR. PABLITO M. ESTORQUE, JR.
OIC, Environmental Monitoring and Enforcement Division
original signed document

Approved by:

ATTY. MICHAEL DRAKE P. MATIAS
Regional Director original signed document

PHOTOS TAKEN DURING THE
QUARTERLY MONITORING

PHOTOS TAKEN DURING THE

PUBLIC CONSULTATION

LABORATORY RESULTS

OPTIMAL LABORATORIES, INC.

Km. 1, Brgy. San Miguel, Puerto Princesa City, Palawan
Tel. No.: (048) 433-0522
Mobile: +63917-8493-193
Email: oli_palawan@yahoo.com.ph

Recognition:
Department of Environment and Natural Resources

CERTIFICATE OF ANALYSIS

Page 1of 1

Customer: **DENR – EMB**
Address: **Sta. Monica, Puerto Princesa City, Palawan**

Job Order No: **18-07-1111**
Date Sampled: **July 5, 2018**
Date Received: **July 6, 2018**
Date Analyzed: **July 9-14, 2018**
Date Reported: **July 17, 2018**
Time Sampled: **3:45 PM**
Sampled by: **Customer**

RESULTS OF ANALYSIS:

Type of Sample: **Upstream (Apurawan)**		Sample ID: **18-2160**
PARAMETER	**METHOD**	**RESULT**
Nitrate as NO_3-N [a]	Colorimetric, Brucine (US EPA 352.1)	0.09 mg / L
Phosphate [a]	Stannous Chloride	< 0.007 mg / L
Total Suspended Solids	Gravimetric, Dried at 103-105ºC	4 mg / L

Sample Description/Condition: The sample is pale yellow and received in plastic bottle transported with ice.

Remark/s: [a] Subcontracted to Optimal Laboratories, Inc. – Lipa City, Batangas on July 9, 2018.

Reference/s: Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

Certified True and Correct by:

Jerson N. Ciriaco, R. Ch.
Laboratory Analyst II
PRC Lic.# 001-2304

Approved by:

Jennifer R. Maralit, R. Ch.
General Manager
PRC Lic. # 000-7374

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Customer: **DENR - EMB**
Address: **Sta. Monica, Puerto Princesa City, Palawan**

Job Order No: **18-07-1111**
Date Sampled: **July 5, 2018**
Date Received: **July 6, 2018**
Date Analyzed: **July 9-14, 2018**
Date Reported: **July 17, 2018**
Time Sampled: **3:00 PM**
Sampled by: **Customer**

RESULTS OF ANALYSIS:

Type of Sample: **Midstream (Apurawan)**		Sample ID: **18-2161**
PARAMETER	METHOD	RESULT
Nitrate as NO_3-N [a]	Colorimetric, Brucine (US EPA 352.1)	0.10 mg / L
Phosphate [a]	Stannous Chloride	< 0.007 mg / L
Total Suspended Solids	Gravimetric, Dried at 103-105°C	3 mg / L

Sample Description/Condition: The sample is pale yellow and received in plastic bottle transported with ice.

Remarks: [a] Subcontracted to Optimal Laboratories, Inc. – Lipa City, Batangas on July 9, 2018.

References: Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012.

Certified True and Correct by:

Jerum N. Ciriaco, R. Ch.
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PRC Lic # 001-2284

Approved by:

Jennifer R. Maralit, R. Ch.
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Page 1of 1

Customer: DENR – EMB
Address: Sta. Monica, Puerto Princesa City, Palawan

Job Order No.: 18-07-1111
Date Sampled: July 5, 2018
Date Received: July 6, 2018
Date Analyzed: July 9-14, 2018
Date Reported: July 17, 2018
Time Sampled: 1:50 PM
Sampled by: Customer

RESULTS OF ANALYSIS:

Type of Sample: Downstream (Apurawan)		Sample ID: 18-2162
PARAMETER	METHOD	RESULT
Nitrate as NO_3-N [a]	Colorimetric, Brucine (US EPA 352.1)	0.17 mg / L
Phosphate [a]	Stannous Chloride	< 0.007 mg / L
Total Suspended Solids	Gravimetric, Dried at 103-105ºC	11 mg / L

Sample Description/Condition: The sample is pale yellow and received in plastic bottle transported with ice.

Remarks: [a] Subcontracted to Optimal Laboratories, Inc. – Lipa City, Batangas on July 9, 2018

References: Standard Methods for the Examination of Water and Wastewater, 22nd Edition, 2012

Certified True and Correct by:

Jerson N. Ciriaco, R. Ch.
Laboratory Analyst II
PRC Lic.# 001-2304

Approved by:

Jennifer R. Maralit, R. Ch.
General Manager
PRC Lic. #000-7374


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FIELD DATA

WATER QUALITY MONITORING FIELD DATA FORM

Name of Water body: Apurawan River
Location: Brgy. Apurawan, Aborlan, Palawan
Date of sampling: 4/17/18 **Sampling Team** Gina L., Grizel S., Micaith E. & Elany S.

PARAMETER	Sampling Site			
GPS Coordinates	Upstream 9°34'26"N 118°23'26"E	Middlestream 9°34'27"N 118°22'12"E	Downstream 9°36'10"N 118°20'34"E	
Time of Sampling	1:22 PM	1:	1:05 PM	
Air Temperature	32°C	32°C	32°C	
Cloud Cover, %	80%	70%	75%	
Weather condition	sunny	sunny	sunny	
Visual Color of Water	Greenish	clear	clear	
Other Observation		Operation of quarry around 20 meters from sampling station		
On-Site Analysis				
pH	7.30	8.10	7.07	
Temperature, °C	28.79	29.72	33.25	
D.O., mg/L	6.17	6.49	3.27	
TDS, g/L	0.284	0.316	18.9	
Conductivity, mS/cm	0.437	0.486	31.1	
Salinity, ppt	0.2	0.2	19.2	
Turbidity, NTU	1.1	1.4	4.5	

Sample for Laboratory Analysis:

Parameters for Analysis	Sample Volume (ml)	Container Type	Sampling Method	Preservation Done

Sampled by: GINA LOCOLITA

ARIZEL BABE A. CABADO

ELANY D. CANICO

WATER QUALITY MONITORING FIELD
DATA FORM

Name of Water body: APURAWAN RIVER
Location:

Date of sampling: JULY 5, 2018 Sampling Team: Gina L, Bea S.

PARAMETER	Sampling Site		
	DOWNSTREAM-POBLACION	MIDSTREAM-MARAHAY	UPSTREAM-PILA
GPS Coordinates	9°36'9"N, 118°20'70"E	9°34'28"N, 118°22'12"E	9°47'65"N, 118°44'64"E
Time of Sampling	1:50 pm	3:00 PM	3:45 pm
Air Temperature	27	29	29
Cloud Cover, %	80%	90%	99%
Weather condition	SUNNY	CLOUDY	CLOUDY
Visual Color of Water	TURBID	CLEAR / GREENISH	CLEAR
Other Observation			
On-Site Analysis			
pH	8.0	8.26	7.74
Temperature, °C	28.35	28.46	28.07
DO, mg/L	6.84	7.98	6.69
TDS, g/L	0.215	0.224	0.220
Conductivity, mS/cm	0.331	0.347	0.339
Salinity, ppt	0.2	0.2	0.2
Turbidity, NTU	14.7	2.01	2.3

Sample for Laboratory Analysis

Parameters for Analysis	Sample Volume (ml)	Container Type	Sampling Method	Preservation Done
Nitrate, Phosphate, TSS	1000	Plastic	Grab	4°C

Sampled by:

JAIME D. BUSTAMANTE

ELANY P. SANICO

GINA TABAYAN

GRIZZEL BEA SABADO

GINA LODONIA

WATER QUALITY MONITORING FIELD DATA FORM

Name of Water body: APURAWAN RIVER

Location: Brgy. Apurawan, Aborlan, Palawan

Date of sampling: 9/11/18 Sampling Team: ______

PARAMETERS	Sampling Site		
	DOWNSTREAM	MIDSTREAM	UPSTREAM
GPS Coordinates	9° 36' 11" N 118° 20' 33" E	9° 34' 27" N 118° 22' 12" E	9° 34' 25" N 118° 23' 26" E
Time of Sampling	3:09 PM	3:47 PM	4:37 PM
Air Temperature	32	30	30
Cloud Cover, %	80%	70%	50%
Weather condition	SUNNY	SUNNY	SUNNY
Visual Color of Water	CLEAR	CLEAR	CLEAR
Other Observation			
On-Site Analysis			
pH	8.44	8.75	8.45
Temperature °C	28.78	27.92	27.27
D.O., mg/L	5.61	6.92	6.77
TDS, g/L	1.51	0.253	0.239
Conductivity, mS/cm	2.76	0.389	0.368
Salinity, PPT	1.2	0.2	0.2
Turbidity, NTU	11.2	1.5	3.5

Sample for Laboratory Analysis

Parameters for Analysis	Sample Volume ml	Container Type	Sampling Method	Preservation Done
TSS, NO3, PO4	1000	Plastic	Grab	4°C

Sampled by:

REYNANTE B. HERMOSA
FANOD

GRIZZEL [illegible] A. SABADO

Jimmy T. [illegible]
Kannud

BARANGAY APURAWAN

GINA LODOVIA

STO NIÑO

WATER QUALITY MONITORING FIELD DATA FORM

Name of Water body: APURAWAN RIVER
Location: Brgy. Apurawan, Aborlan, Palawan

Date of sampling: 10/22/18 **Sampling Team** ______

PARAMETER	Sampling Site		
	Sta. 1	Sta. 2	Sta. 3
GPS Coordinates	UPSTREAM	MIDSTREAM	DOWNSTREAM
Time of Sampling	3:03PM	1:55 PM	12:24 PM
Air Temperature	28	28	28
Cloud Cover , %	95	98	100
Weather condition	SUNNY	CLOUDY	RAINY
Visual Color of Water	GREENISH/clear	GREENISH/clear	GREENISH/TURBID
Other Observation	Traces of Quarry activity near the station		
On-Site Analysis			
pH	8.55	8.51	8.45
Temperature, °C	25.00	24.88	25.16
D.O., mg/L	7.83	7.59	8.38
TDS, g/L	0.193	0.198	0.195
Conductivity, mS/cm	0.299	0.305	0.301
Salinity, ppt	0.1	0.1	0.1
Turbidity, NTU	3.9	4.0	10.2

Sample for Laboratory Analysis:

Parameters for Analysis	Sample Volume (ml)	Container Type	Sampling Method	Preservation Done
TSS, NO3, PO4	1000	Plastic	Grab	maintained at 4°C

Sampled by:

ELANY P. SANICO
DENR CENRO PPC

RANIE CATAPE
BARANGAY TANOD
BARANGAY APURAWAN

GRIZZEL BEA A. SABADO
EMAB

Jaime D. BUSTAMANTE
MENRO - MMT

GINA LODONIA

MIN UTES OF THE PUBLIC HEARING

ATTENDANCE SHEET