Republic of the Philippines
Department of Environment and Natural Resources
MIMAROPA Region
PROVINCIAL ENVIRONMENT AND NATURAL RESOURCES OFFICE

MAR 24 2023

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BY: DATS NO.
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MEMORANDUM

FOR : The Regional Executive Director
DENR MIMAROPA Region
1515 DENR By the Bay Building, Roxas Boulevard,
Barangay 668, Ermita, Manila

THRU : The ARD for Technical Services

FROM : The OIC, PENR Officer

SUBJECT : **SUBMISSION OF THE WATER QUALITY MONITORING REPORT OF APO REEF NATURAL PARK FOR THE DRY SEASON OF CY 2023**

Forwarded is the memorandum dated March 20, 2023 regarding submission of the water quality monitoring report of Apo Reef Natural Park for the Dry Season. The method for Water Quality Monitoring is combination of laboratory analyses and in-situ measurements made using the HORIBA U-51 water quality checker.

Attached herewith is the narrative report and its appendices.

For information and record.

ERNESTO E. TAÑADA

So. Pag-asa, Brgy. Payompon, Mamburao, Occidental Mindoro
Email:penrooccmin@denr.gov.ph

Department of Environment and Natural Resources
MIMAROPA Region
COMMUNITY ENVIRONMENT AND NATURAL RESOURCES OFFICE

March 20, 2023

MEMORANDUM

FOR : The Regional Executive Director
DENR MIMAROPA Region
1515 DENR By the Bay, Roxas Blvd.
Brgy 668, Ermita Manila

THRU : The PENR Officer
Mamburao, Occidental Mindoro

FROM : CENR Officer

SUBJECT : SUBMISSION OF THE WATER QUALITY MONITORING REPORT OF APO REEF NATURAL PARK FOR THE DRY SEASON OF CY 2023

Respectfully submitted is the Water Quality Monitoring Report of Apo Reef Natural Park for the dry season of CY 2023. The method for WQMA is combination of laboratory analyses and in-situ measurements made using the HORIBA U-51 water quality checker. Attached herewith is the narrative report and its appendices.

For your approval.

For the CENR Officer:

ISAIAS A. GUIMOD
DMO IV/ Deputy CENR Officer

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DATE: 3/24/23 TIME: 11:00AM

National Road, Brgy.Sto. Niño, Sablayan, Occidental Mindoro
E-mail: cenrosablayan@denr.gov.ph

Department of Environment and Natural Resources
MIMAROPA Region
APO REEF NATURAL PARK
Protected Area Management Office

March 20, 2023

MEMORANDUM

FOR : The Regional Executive Director
DENR MIMAROPA Region
1515 DENR By the Bay Building, Roxas Boulevard,
Barangay 688, Ermita, Manila

THRU : The OIC, PENR Officer
Mamburao, Occidental Mindoro

The CENR Officer

FROM : The Protected Area Superintendent

SUBJECT : SUBMISSION OF THE WATER QUALITY MONITORING REPORT OF APO REEF NATURAL PARK FOR THE DRY SEASON OF CY 2023

Respectfully submitted is the Water Quality Monitoring Report of Apo Reef Natural Park for the dry season of CY 2023. The results of the laboratory analyses and in-situ measurements made using the HORIBA U-51 water quality checker are presented below.

Parameters		Measurements*							
	RS	TIEZA	LH	RK	PG	EW	SA1	SA2	SAC
Temperature (°C)	28.6	29.3	27.2	27.3	27.3	27.2	27.3	27.4	27.3
Color (TCU)	5	5	<5	<5	<5	<5	<5	<5	<5
Total Suspended Solids (mg/L)	2	1	2	2	2	6	6	9	13
Fecal Coliform Count (MPN/100mL)	<1.8	<1.8	<1.8	<1.8	2	4.5	<1.8	2	<1.8
Dissolved Oxygen (mg/L)	5.02	4.00	6.81	5.03	4.68	5.88	5.82	6.01	6.28
Nitrate (mg/L)	<0.06	2.54	<0.06	<0.06	<0.06	0.09	<0.06	<0.06	<0.06
Oil and grease (mg/L)	3	9	3	2	3	2	3	3	4
pH (Range)	6.62	7	7.27	7.25	7.14	7.62	8.45	8.46	8.22
Phosphate (mg/L)	<0.03	0.13	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Surfactants (mg/L)	0.09	0.19	0.12	0.08	0.07	0.09	0.1	0.13	0.22

*TIEZA –TIEZA Bldg. well, RS –Ranger's Station well, LH – East of Lighthouse, RK – East of Ranger's Kiosk, PG – East of Picnic Ground, EW – Ego Wall, SA1 – San Antonio 1, SA 2 – San Antonio 2, SC – South Corner

Amongst this, listed in red are the measurements which did not meet the Class SA and Class B standard as per DENR Department Administrative Order (DAO) No. 2016-08 as amended by DAO No. 2021-19. Attached herewith is the narrative report and its appendices.

For information and record.

KRYSTAL DAYNE T. VILLANADA

National Highway, Brgy.Sto. Niño, Sablayan, Occidental Mindoro
E-mail: aporeefnaturalpark@gmail.com

Water Quality Monitoring Report

1st Semester of 2023

I. INTRODUCTION

Water quality is an important factor in coastal and marine ecosystems. It impacts the species richness or the number of species present in a community within an ecosystem among others (Johnston & Roberts, 2009). However, human activities have continuously caused a decrease in water quality, driving the degradation of coastal and marine ecosystems worldwide. For instance, harmful algal blooms (HABs), likely caused by anthropogenic nutrient enrichment, has led to large fish kills in Asia (Furuya et al., 2018). Outbreaks of Crown-of-Thorns Starfish (CoTS), which has resulted to large-scale coral declines, are also widely hypothesized to be linked to anthropogenic nutrient enrichment (Wooldridge & Brodie, 2015; Brodie et al., 2017). This is why the monitoring and improvement of water quality is critical to the management of coastal and marine resources.

Water quality monitoring is vital in developing policies and management decisions for water bodies, especially those that are delegated as Protected Areas (PAs) like Apo Reef Natural Park (ARNP). In the Philippines, the implementation of the Coastal and Marine Ecosystems Management Program (CMEMP), under the supervision of the DENR Biodiversity Management Bureau, includes Water Quality Monitoring (WQM) within legislated NIPAS PAs as a subcomponent. It aims to quantify the pollution load and other water parameters that indicate pollution in PAs. This is the third year of implementation of this subcomponent of CMEMP in ARNP.

The water quality in Apo Reef Natural Park is monitored twice yearly, covering the dry and wet seasons. The following are the specific objectives of the WQM in ARNP this year:

1. To establish two additional permanent monitoring stations within the Protected Area;
2. To collect data on water quality parameters in the nine monitoring stations; and,
3. To implement necessary management actions.

II. METHODOLOGY

Monitoring stations

There are nine permanent WQM stations in ARNP (Table 1; Figure 1). Two of which were recently established by virtue of PAMB Resolution No. 2023-005: South Corner and TIEZA. The monitoring stations are distributed across the two different management zones of ARNP. Six monitoring stations are within the Multiple-Use Zone, while the remaining three are within the Strict Protection Zone.

The WQM involved the sampling of both surface water and groundwater, and seven of the nine monitoring stations were sampled for surface water. Three of which were located along the bathing beach in Apo Island (Lighthouse, Picnic Ground, and Ranger's Kiosk). These sites were less than 1 m in depth and situated at least 300 meters away from each other following the guidelines of DENR EMB (2008). The depth in the three other stations sampled for surface water (Ego Wall, San Antonio 1, San Antonio 2, and South Corner) were approximately 10 m.

Table 1. Water quality standards for Class SA and Class B water bodies.

WQM Station	Abbreviation	Sample Source	Management Zone
TIEZA Bldg. Groundwater Well	TIEZA	Groundwater	MUZ
Ranger's Station Groundwater Well	RS	Groundwater	MUZ
East of Lighthouse	LH	Surface water	MUZ
East of Ranger's Kiosk	RK	Surface water	MUZ
East of Picnic Ground	PG	Surface water	MUZ
Ego Wall	EW	Surface water	MUZ
San Antonio 1	SA1	Surface water	SPZ
San Antonio 2	SA2	Surface water	SPZ
South Corner	SC	Surface water	MUZ

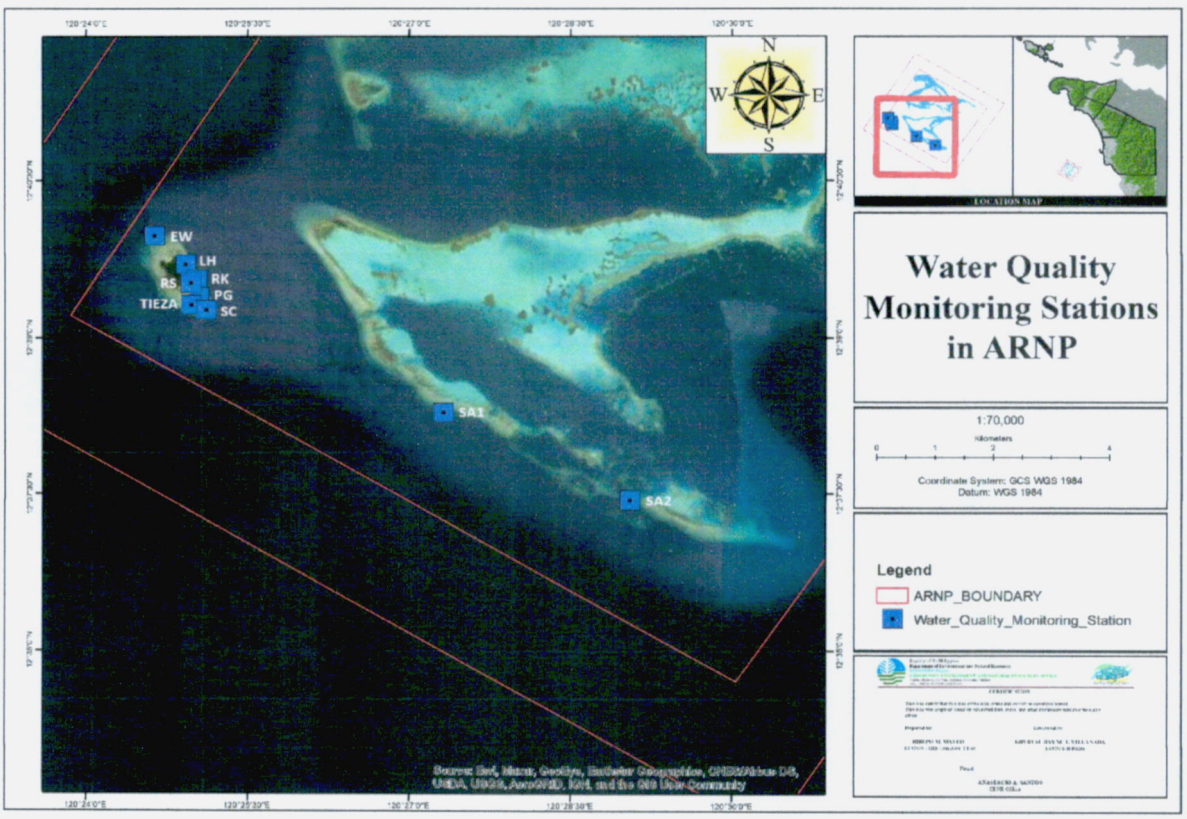

Figure 1. Map of the seven water quality monitoring stations sampled on March 2, 2023.

Two of the nine monitoring stations were sampled for groundwater: the groundwater well at the Ranger's Station and the other one at the Administrative Building (TIEZA). Water from these groundwater wells is regularly accessed by either tourists or management staff using a galvanized iron hand pump and an electric water pump. Both stations are adjacent to a septic tank system on the island which is a potential source for groundwater contaminants.

Field Collection and Laboratory Analysis

The collection of water samples was conducted on March 2, 2023 by personnel of the Protected Area Management Office of ARNP (ARNP-PAMO) and the Municipal Environment

and Natural Resources Office (MENRO) of Sablayan. The sampling was done from 4:00 AM to 7:30 AM, to ensure that the samples reach Optimal Laboratories Inc. in Lipa, Batangas on the same day. Air temperature, percent cloud cover, weather condition, and visual color of water were noted prior to the collection of water samples in each site. Dissolved oxygen (DO), pH, and temperature were then measured in-situ using the U-51 multiparameter water quality checker (HORIBA, Kyoto, Japan). In sites with depths greater than 5 m, the measurement was done at three different depths and then averaged. The water quality checker was also used to measure DO and pH while purging out the stagnant water from the groundwater well.

Two grab sampling methods were employed during the activity: discrete and depth-integrated. Discrete grab sampling was used to sample water from the groundwater wells (Ranger's Station and TIEZA) and monitoring stations along the bathing beach (Picnic Ground, Ranger's Kiosk, and Lighthouse). Sampling was done directly using the sample containers which were as follows: 1L wide-mouthed glass, 2L plastic container, and sterile glass bottle. On the other hand, depth-integrated sampling was used in sites with depths greater than 5 meters (Ego Wall, San Antonio 1, San Antonio 2, and South Corner). Water from surface (0.10-0.50 m), middle layer (~5 m), and near-bottom depth (9.5-10 m) was collected using an improvised PVC sampling device (Figure 2). Three PVC sampling device were tied to a 10-m rope at the mentioned depths. Unlike Van Dorn samplers which feature messengers, two divers manually closed the stoppers of each sampling device. The water samples from the three different depths were then poured into similar sampling containers and mixed.

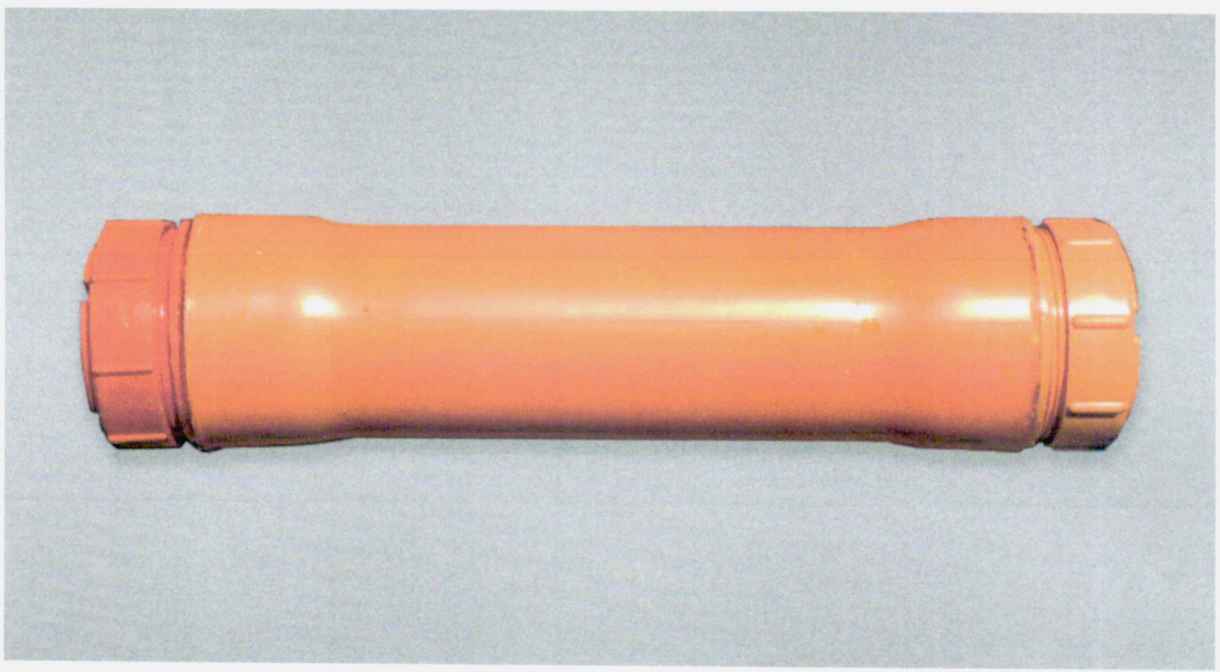

Figure 2. PVC sampling device used in collecting samples from different depths (surface, middle-layer, and near-bottom) at Ego Wall.

All samples were immediately stored in a cooler filled with ice to preserve the samples by maintaining the temperature at approximately 4 °C. The samples were then transported to Optimal Laboratories Inc. in Lipa, Batangas from 7:30 AM to 3:00 PM. Seven water quality parameters were measured in the laboratory (Table 2).

Table 2. Water quality parameters measured in the laboratory by Optimal Laboratories Inc.

Water Quality Parameter	Methodology
Color	Visual Comparison
Total Suspended Solids	Gravimetric Dried at 103-105
Fecal Coliform Count	Multiple Tube Fermentation
Nitrate	Brucine Colorimetric
Phosphate	Stannous Chloride
Surfactants	Anionic Surfactants as MBAS
Oil & Grease	LLP-Gravimetric (PET)

Data Analysis

The results were then compared to standards based on intended beneficial use (DENR EMB, 2008). Specifically, the results for the surface water were compared to the standards for Class SA (Protected Waters and Fishery Class I), which is the highest classification for marine waters (Table 3). Meanwhile, the standards used for groundwater is for Class B (Bathing and Other Primary Contact Recreation). The DENR Department Administrative Order (DAO) No. 2016-08 as amended by DAO No. 2021-19 were primarily used as reference for the permissible thresholds per parameter.

Table 3. Water quality standards for Class SA and Class B water bodies.

Water Quality Parameter	Class SA	Class B
Temperature (°C)	26-30	26-30
Dissolved Oxygen (mg/L)	6	n/a
pH	7.0-8.5	7.0-8.5
Color	5	50
Total Suspended Solids (mg/L)	25	65
Fecal Coliform Count (MPN/100 mL)	20	100
Nitrate (mg/L)	10	7
Phosphate (mg/L)	0.1	0.025
Surfactants (mg/L)	0.03	0.03
Oil & Grease (mg/L)	1	1

III. RESULTS AND DISCUSSION

Physical Parameters

All stations passed the water quality standards set by the DENR EMB for the three physical parameters measured: color, temperature, and total suspended solids (Table 4). The concentrations for suspended solids across the stations, which ranged from 1 to 13 mg/L, were well within the permissible thresholds for Class SA (≤ 25 mg/L) and Class B (≤ 65 mg/L) water bodies. The low TSS in ARNP may be attributed to its remote location and consequently, distance from human activities that increase sediment loads in marine environments such as mining and dredging operations, coastal development, and agriculture. Elevated TSS concentrations have been correlated with coral degradation (Flores et al., 2012; Parwati et al., 2013) hence, the low TSS concentrations are favorable to coral reefs within ARNP.

Table 4. Color, temperature, and total suspended solids measurements in the nine water quality monitoring stations in ARNP.

Parameters	Measurements								
	RS	TIEZA	LH	RK	PG	EW	SA1	SA2	SEC
Temperature (°C)	28.6	29.3	27.2	27.3	27.3	27.2	27.3	27.4	27.3
Color (TCU)	5	5	<5	<5	<5	<5	<5	<5	<5
Total Suspended Solids (mg/L)	2	1	2	2	2	6	6	9	13

Biological Parameters

All stations in ARNP had low fecal coliform counts (FCC), ranging from <1.8 to 4.5 MPN/100 mL (Table 5). These concentrations pass the set standards for Class SA and Class B water bodies which are 20 MPN/100 mL and 100 MPN/100 mL, respectively. FCC in groundwater wells near the septic tanks were below the detection limit (<1.8 MPN/100 mL) thus, water from these groundwater wells may be continuously used as domestic water supply. Similarly, the bathing beach and dive sites are deemed safe for full body contact recreation because the FCC in these stations only ranged from <1.8 to 4.5 MPN/100 mL.

Table 5. Fecal coliform counts in the nine monitoring stations in ARNP.

Parameters	Measurements								
	RS	TIEZA	LH	RK	PG	EW	SA1	SA2	SEC
Fecal Coliform Count (MPN/100mL)	<1.8	<1.8	<1.8	<1.8	2	4.5	<1.8	2	<1.8

Values in red mark measurement that failed standards set by DENR EMB.

Chemical Parameters

All monitoring stations passed the set standards for the following chemical parameters: pH, nitrate, and surfactants (Table 6). It is, however, important to note that the nitrate level at the groundwater well at TIEZA (2.54 mg/L) was the highest among the stations. The phosphate concentration in this station was beyond the permissible threshold for Class B water bodies (0.1 mg/L). Sewer leakage remains to be one of the potential sources of the higher nutrient levels in the station even if FCC was low (>1.8 MPN/100 mL). This is because the movement of coliform and nutrients in groundwater through an aquifer may vary. For instance, Entry & Farmer (2001) recorded lower fecal coliform but higher NO_3 concentrations in water flowing across a sand aquifer. Despite these findings in the groundwater well at TIEZA, nutrient levels in majority of the stations were low. Minimizing nutrient input into the marine environment is important because these may cause HABs (Furuya et al., 2018) and facilitate or exacerbate CoTS Outbreaks (Wooldridge & Brodie, 2015; Brodie et al., 2017).

None of the monitoring stations passed the set standards for oil and grease (1 mg/L) and four of the stations tested for surface water quality (RK, PG, EW, and SA1) did not reach the lower limit of the standard for DO concentration (6 mg/L). DO concentrations in RK, PG, EW, and SA1 areas only ranged from 4.675 to 5.88 mg/L. These low DO concentrations are likely due to the time of sampling. Photosynthetic production specifically by marine phytoplankton is low from dusk to dawn (Harding et al., 1981; Kana et al., 1985) hence, DO is significantly decreased because of the continuous respiration of different marine organisms. Contrastingly, the likely cause of the increased oil and grease levels across the monitoring stations (2-9 mg/L) is anthropogenic. It may be specifically attributed to marine transportation

activities within and proximal to ARNP. The MPA is proximal to domestic shipping routes, particularly long-distance primary routes which connect major ports in the country (MARINA, 2018). Ropax vessels (RoRo passenger-cargo vessels) and cargo vessels including container and tanker ships are serving mainly for these routes (JICA, 2005). These vessels release oil into the sea in their routine operations, and as a result of major accidents like collisions and groundings. Other vessels such as commercial and small-scale fishing boats and recreational boats may also be contributing to oil pollution in ARNP.

Table 6. Dissolved oxygen, phosphate, pH, and oil and grease measurements in the seven water quality monitoring stations.

Parameters	Measurements								
	RS	TIEZA	LH	RK	PG	EW	SA1	SA2	SAC
Dissolved Oxygen (mg/L)	5.02	4.00	6.81	5.03	4.68	5.88	5.82	6.01	6.28
Nitrate (mg/L)	<0.06	2.54	<0.06	<0.06	<0.06	0.09	<0.06	<0.06	<0.06
Oil and grease (mg/L)	3	9	3	2	3	2	3	3	4
pH (Range)	6.62	7	7.27	7.25	7.14	7.62	8.45	8.46	8.22
Phosphate (mg/L)	<0.03	0.13	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Surfactants (mg/L)	0.09	0.19	0.12	0.08	0.07	0.09	0.1	0.13	0.22

Values in red mark measurement that failed standards set by DENR EMB.

IV. CONCLUSIONS AND RECOMMENDATIONS

Nine monitoring stations were sampled for surface water and groundwater on March 8, 2023. Two of these monitoring stations were recently established by virtue of PAMB Resolution No. 2023-005. All monitoring stations passed the DENR EMB-set standards (Class SA and B) for the physical and biological water quality parameters measured. The FCC across monitoring stations (>1.8 to 4.5 MPN/100 mL) well within the permissible thresholds, with most stations having FCC less than detection limit (>1.8 MPN/100 mL). Thus, the surface water and groundwater across the monitoring stations, and ARNP at large, are safe for full body contact during recreation and bathing and other domestic uses.

Of the six chemical water quality parameters measured, phosphate, dissolved oxygen, and oil and grease were the ones wherein at least one of the monitoring stations failed the set standards. The low dissolved oxygen levels recorded in four of the monitoring stations are only likely due to the time of sampling which is within a period of decreased phytoplankton activity. Sampling time may be adjusted accordingly as more equipment and watercraft becomes available. Contrastingly, the sources of the increased levels of phosphate and oil and grease are likely anthropogenic. The increased concentration of phosphate in the groundwater well in TIEZA building (0.13 mg/L), as well as nitrate (2.54 mg/L), may indicate leakage from the proximal septic tank system. Thus, the regular monitoring of water quality in this station and inspection of the nearby septic tank system are recommended.

For oil and grease, all stations exceeded the permissible threshold of ≤ 1 mg/L. Marine transport activities remain to be the most likely source of the increased oil and grease recorded which ranged from 2 to 9 mg/L. Being proximal to navigational shipping lanes, the Protected Area is mainly exposed to oil discharge from Ropax and cargo vessels during transport. Commercial and small-scale fishing boats and recreational boats operating inside or outside

the Protected Area may also be contributing to oil pollution in the area but to a much lesser extent. Apart from these, ARNP is also vulnerable to ship grounding incidents and massive oil spills. Therefore, the response plans for ship grounding incidents and oil spills should be developed. Learnings from the response to the oil spill in Oriental Mindoro from the sunken MT Princess Empress should be well-integrated into the plan.

It is also recommended that other quality assurance and control measures, like the collection of fields blank, equipment blank, and field duplicates, be taken when more funding becomes available. Furthermore, sampling sites within the Protected Area may be increased improve the generality of the findings.

Prepared by:

HUGO IGNACIO G. SALVADOR
CMEMP Extension Officer

Reviewed and submitted by:

KRYSTAL DAYNE T. VILLANADA
Protected Area Superintendent

V. REFERENCES

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VI. APPENDICES

Appendix A. Participants of the water sampling in Apo Reef Natural Park on March 2, 2023.

Name	Position	Office
Krystal Dayne T. Villanada	Protected Area Superintendent	ARNP-PAMO
Anna Ritchelle D. Nicanor	Park Maintenance Foreman	ARNP-PAMO
Roberto P. Beringuela	Park Maintenance Foreman	ARNP-PAMO
Efraim Z. Pagador	Forest Ranger	ARNP-PAMO
Romel M. Pacaul	Boat Captain	ARNP-PAMO
Mark Dennis M. Barretto	Boat Captain	ARNP-PAMO
Raymart R. Dangeros	Boat Crew	ARNP-PAMO
Temart E. Rebito	Park Ranger	ARNP-PAMO
Kelvin U. Zubiri	Park Ranger	ARNP-PAMO
Federico A. de Jesus	Park Ranger	ARNP-PAMO
Sherwin R. Benoza	Park Ranger	ARNP-PAMO
Salvador M. Ciasico	Park Ranger	MENRO Sablayan
Elpidio Amores	Park Ranger	MENRO Sablayan

Appendix B. Photodocumentation of the water sampling in the nine monitoring stations in Apo Reef Natural Park on March 2, 2023.

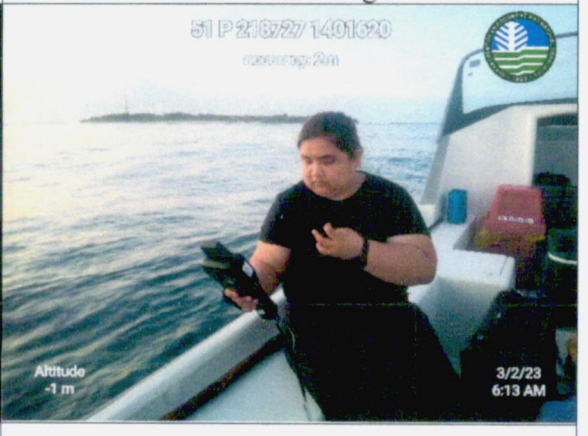
PAMO Staff purging stagnant water out of the groundwater well at the Ranger's Station

Park Ranger Kelvin Zubiri (right) collecting water samples in front of the lighthouse

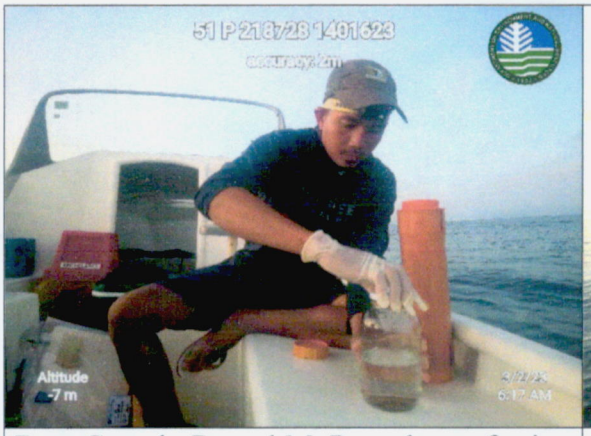
Park Ranger Kelvin Zubiri (left) and PASu Villanada measuring DO, pH, and temperature in-situ

Boat Captain Mark Barretto (left) and PASu Krystal Villanada measuring parameters in-situ in front of the Ranger's Kiosk

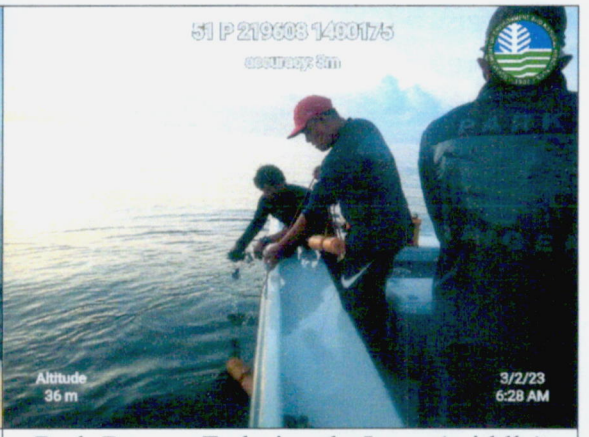
Boat Captain Romel M. Pacaul transferring the groundwater samples collected in front of the Ranger's Kiosk into the cooler



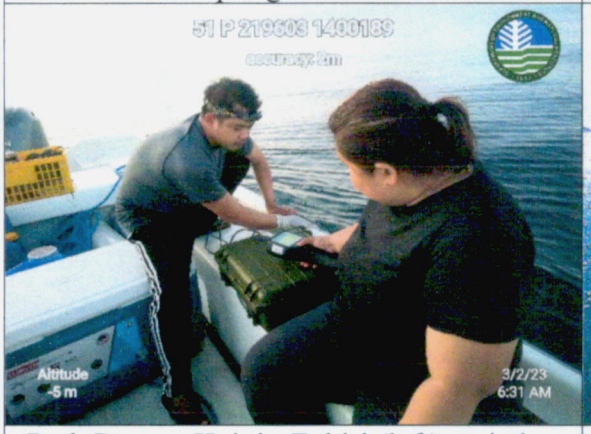
PASu Krystal Villanada measuring several water quality parameters in-situ at Ego Wall



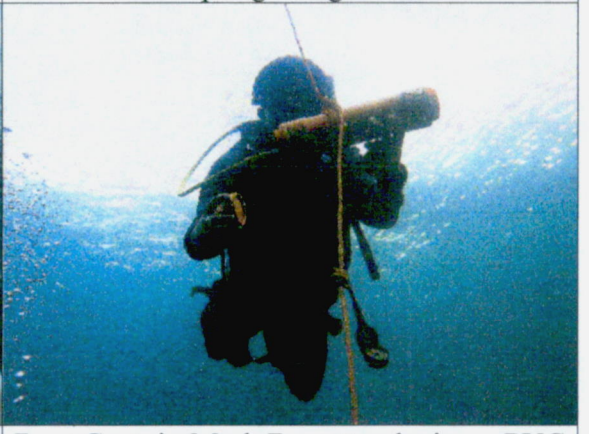
Boat Captain Romel M. Pacaul transferring water samples from the sampler into the sampling containers



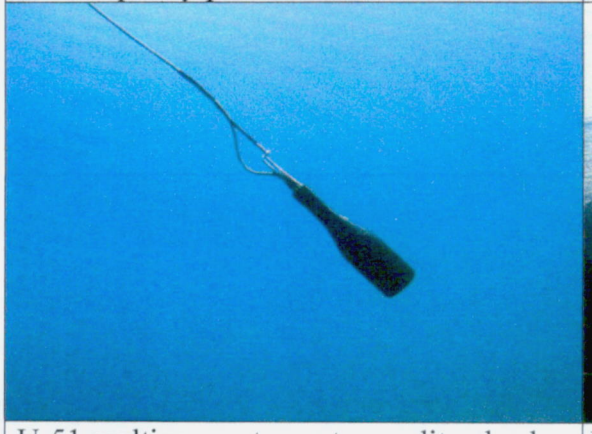
Park Ranger Federico de Jesus (middle) retrieving the water samplers during the sampling in Ego Wall



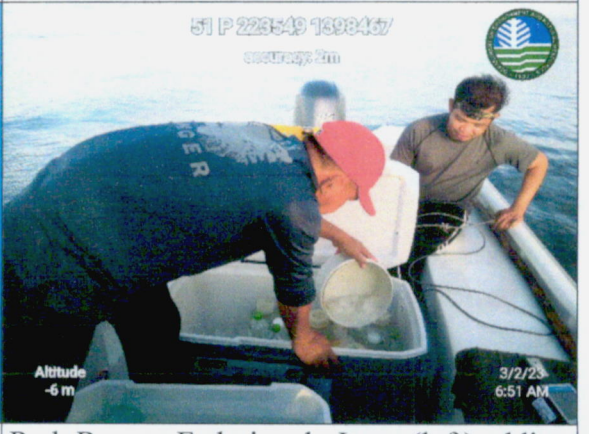
Park Ranger Kelvin Zubiri (left) assisting the probe during the in-situ measurement water quality parameters at South Corner



Boat Captain Mark Barretto closing a PVC water sampler at Ego Wall



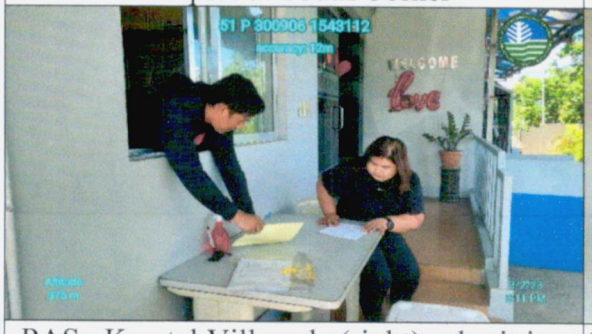
U-51 multiparameter water quality checker probe submerged approximately 5 m at Ego Wall



Park Ranger Federico de Jesus (left) adding ice into the cooler for the preservation of water samples during transport

Boat Captain Romel Pacaul (right) washing the sampler prior to the collection of water samples at South Corner

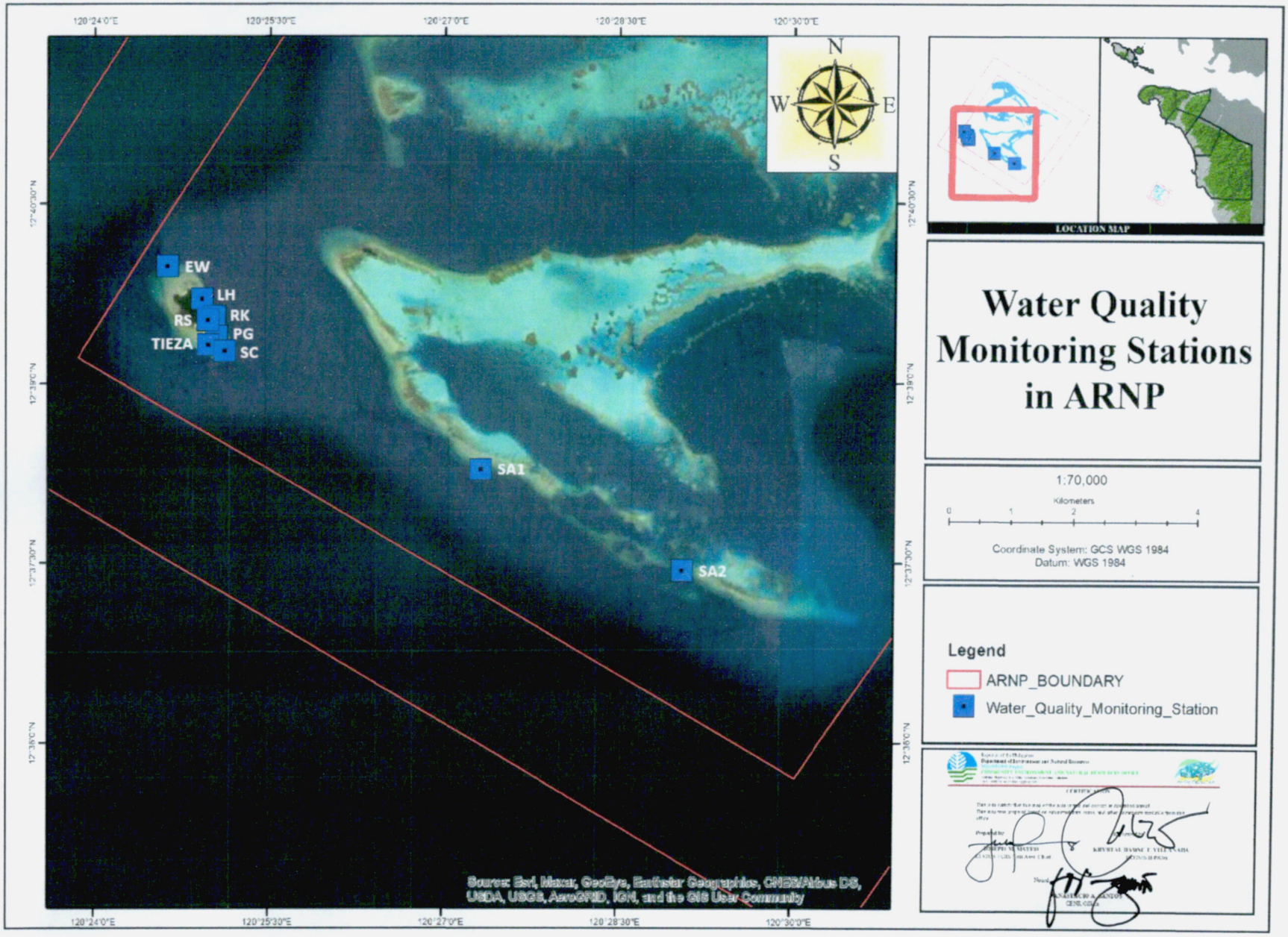
Boat Captain Romel Pacaul (left) and Park Ranger Kelvin Zubiri transferring water samples from the sampler



PASu Krystal Villanada (right) submitting finalizing the chain of custody forms for the laboratory analyses of the water samples

SCDO Anna Ritchelle Nicanor checking the documents received from Optimal Laboratories Inc.

Appendix C. Map showing the seven water quality monitoring stations in Apo Reef Natural Park



Appendix D. Results of the laboratory analyses of samples collected on March 2, 2023.

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Department of Environment and Natural Resources • DA - Bureau of Animal Industry • Department of Health • Food and Drug Administration

CERTIFICATE OF ANALYSIS

Customer : **APO REEF NATURAL PARK**
Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **5:30 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - GW**		Lab Sample ID: **23-02122-001**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	3 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.09 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	2 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

Certified True and Correct by:

Ranmar Marco A. Marco, RCh
Laboratory Analyst II
PRC Lic. #0014151

Approved by:

Jennifer R. Maralit, RCh
General Manager
PRC Lic. # 0007374

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LA-2012-218C

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CERTIFICATE OF ANALYSIS

Customer : **APO REEF NATURAL PARK**
Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 02, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **5:30 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - GW**		Lab Sample ID: **23-02122-001**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	<1.8 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.
References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

Shyla May L. Quizon, RMT
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PRC Lic. #0075710

Jonahdimary R. Alilio
Laboratory Analyst III

Approved by:

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Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **4:30 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - PG**		Lab Sample ID: **23-02122-002**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	3 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.07 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	2 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

Certified True and Correct by:

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Approved by:

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Date Received : **March 02, 2023**
Date Analyzed : **March 02, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **4:30 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - PG**		Lab Sample ID: **23-02122-002**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	2.0 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.
References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

Shyla May L. Quizon, RMT
Laboratory Analyst II
PRC Lic. #0075710

Jonahdimary R. Alilio
Laboratory Analyst III

Approved by:

Jennifer R. Maralit, RCh
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Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **4:06 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - LH**		Lab Sample ID: **23-02122-003**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	3 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.12 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	2 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

Certified True and Correct by:

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Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **4:40 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - RK**		Lab Sample ID: **23-02122-004**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	2 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.08 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	2 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

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CERTIFICATE OF ANALYSIS

Customer : **APO REEF NATURAL PARK**
Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 02, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **4:40 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - RK**		Lab Sample ID: **23-02122-004**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	<1.8 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.

References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

Shyla May L. Quizon, RMT
Laboratory Analyst II
PRC Lic. #0075710

Jonahdimary R. Alilio
Laboratory Analyst III

Approved by:

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Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **6:15 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - EW**		Lab Sample ID: **23-02122-005**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	0.09 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	2 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.09 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	6 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

Certified True and Correct by:

Ranmar Marco A. Marco, RCh
Laboratory Analyst II
PRC Lic. #0014151

Approved by:

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Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 02, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **6:15 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - EW**		Lab Sample ID: **23-02122-005**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	4.5 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.
References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

Shyla May L. Quizon, RMT
Laboratory Analyst II
PRC Lic. #0075710

Jonahdimary R. Alilio
Laboratory Analyst III

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Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **7:00 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - SA1**		Lab Sample ID: **23-02122-006**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	3 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.1 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	6 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

Certified True and Correct by:

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Approved by:

Jennifer R. Maralit, RCh
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CERTIFICATE OF ANALYSIS

Customer : **APO REEF NATURAL PARK**
Address : **Brgy. Sto. Niño, Sablayan, Occidental Mindoro**

Work Order : **23-02122**
Date Collected : **March 02, 2023**
Date Received : **March 02, 2023**
Date Analyzed : **March 02, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **7:00 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - SA1**		Lab Sample ID: **23-02122-006**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	<1.8 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.
References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

Shyla May L. Quizon, RMT
Laboratory Analyst II
PRC Lic. #0075710

Jonahdimary R. Alilio
Laboratory Analyst III

Approved by:

Jennifer R. Maralit, RCh
General Manager
PRC Lic. # 0007374

Results of analysis refer only to the sample of material submitted by the customer. This report/certificate cannot be reproduced without written authorization from Optimal Laboratories, Inc. and Not Valid without official Company dry seal. This will be file for 5 years from date of issue.

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Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **7:20 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - SA2**		Lab Sample ID: **23-02122-007**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	3 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.13 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	9 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

Certified True and Correct by:

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Approved by:

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Date Reported : **March 13, 2023**
Time Collected: **7:20 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - SA2**		Lab Sample ID: **23-02122-007**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	2.0 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.

References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

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Jonahdimary R. Alilio
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Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **6:35 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - SC**		Lab Sample ID: **23-02122-008**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	<5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	<0.06 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	4 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	<0.03 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.22 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	13 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

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Date Reported : **March 13, 2023**
Time Collected: **6:35 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - SC**		Lab Sample ID: **23-02122-008**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	<1.8 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.
References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

Certified True and Correct by:

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Date Analyzed : **March 03, 2023 - March 09, 2023**
Date Reported : **March 13, 2023**
Time Collected: **4:20 AM**
Submitted By : **Customer**

RESULTS OF ANALYSIS:

Customer Sample ID : **Water - TIEZA**		Lab Sample ID: **23-02122-009**
PARAMETER	**METHOD**	**RESULT**
Color (True Color)	2120 B. Visual Comparison [a]	5 TCU
Nitrate as NO3-N	352.1 Colorimetric, Brucine [b]	2.54 mg/L
Oil and Grease	5520 B. Liquid-Liquid, Partition-Gravimetric [a]	9 mg/L
Phosphate as Phosphorus	4500 -P D. Stannous Chloride [a]	0.13 mg/L
Surfactants (MBAS)	5540 C. Anionic Surfactants as MBAS [a]	0.19 mg/L
Total Suspended Solids	2540 D. Gravimetric, Dried at 103-105°C [a]	1 mg/L

Sample Description/Condition: The sample is clear with few suspended solids and received in glass and plastic containers transported with ice.

References:
[a] Standard Methods for the Examination of Water and Wastewater, 23rd Edition, 2017
[b] US EPA 352.1. Standard Methods for the Examination of Water and Wastewater, 13th Edition.

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RESULTS OF ANALYSIS:

Customer Sample ID : **Water - TIEZA**		Lab Sample ID: **23-02122-009**
PARAMETER	**METHOD**	**RESULT**
Thermotolerant (Fecal) Coliform Count	Multiple Tube Fermentation Technique [a]	<1.8 MPN/100 mL

Sample Description/Condition: The sample is clear with few suspended solids and received in sterile bottle transported with ice.

References: [a] Standard Methods for the Examination of Water and Wastewater 23rd ed. 2017

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Appendix E. Other field observations in each monitoring station last March 2, 2023.

Parameter	Monitoring Stations*								
	RS	TIEZA	LH	RK	PG	EW	SA1	SA2	SC
Air Temperature	28.3	28.71	28.3	27.37	27.8	28.3	28.3	28.3	28.3
Cloud Cover	10%	10%	10%	10%	10%	10%	10%	10%	10%
Weather Condition	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair
Visual Color of Water	Clear	Clear	Blue green	Blue green	Blue green	Blue	Blue	Blue	Blue