DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)

SMFI LUCANIN MULT-TIER BROILER FARM PROJECT



Submitted by:
San Miguel Foods, Inc. (SMFI)
100 E. Rodriguez Jr. Avenue, Ugong, Pasig City

Submitted to:
Authority of The Freeport Area of Bataan
AFAB Administration Building, Freeport Area of Bataan, Mariveles, Bataan

Prepared by:
Brown and Green Environmental Services, Inc.
Blk 2 Lot 8, Maris Townhomes, San Jose, Antipolo City

October 2023

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LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
ABR	Anaerobic Baffled Reactor
ACES	ACES Distribution and Consulting Services, Inc
AFAB	Authority of the Freeport Area of Bataan
ASP	Amnesic Shellfish Poisoning
BA	Basal Area
BAPAs	Barangay Power Associations
BDO	Banco De Oro
BEPZ	Bataan Economic Processing Zone
BFAR	Bureau of Fisheries and Agriculture
BGSI	Brown & Green Environmental Services, Inc
BSWM	Bureau of Soils and Water Management
CARP	Comprehensive Agrarian Reform Program
CBMS	Community Based Monitoring System
CITES	Convention on International Trade in Endangered Species
CLUP	Comprehensive Land Use Plan
CLUP	Comprehensive Land Use Plan
CMR	Compliance Monitoring Report
CO	Carbon Monoxide
COD	chemical oxygen demand
CR	Critically Endangered
CSR	Corporate Social Responsibility
DA	Domoic Acid
DAO	Department Administrative Order
DBH	Diameter at Breast Height
DD	Data Deficient
DENR	Department of Environmental and Natural Resources
DENR	Department of Environment and Natural Resources
DO	Dissolved Oxygen
DPWH	Department of Public Works and Highways

ECAs	Environmentally Critical Areas
ECC	Environmental Compliance Certificate
ECC	Environmental Compliance Monitoring
EIA	Environmental Impact Assessment
EIARC	Environmental Impact Assessment Review Committee
EIS	Environmental Impact Statement
EM	Environmental Monitoring
EMoP	Environmental Monitoring Plan
EN	Endangered
EW	Extinction in the Wild
EX	Extinct
FAB	Freeport Area of Bataan
GES	General Effluent Standards
GES	General Effluent Standards
HARBs	Harmful Algal Blooms
IEC	Information Education Communication
IMP	Impact Management Plan
IUCN	International Union for Conservation of Nature
IV	Important Value
LBP	Land Bank of the Philippines
LC	Least Concern
LGU	Local Government Unit
MARIWAD	Mariveles Water District
MBTC	Metropolitan Bank & Trust Corp
MRF	Material Recovery Facility
NAMRIA	National Mapping and Resource Information Authority
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NCIP	National Commission on Indigenous Peoples
NE	Not Evaluated
NFRDI	National Fisheries Research and Development Institute
NHCP	National Historical Commission of the Philippines
NHCP	National Historical Commission of the Philippines
NOx	Nitrogen Oxide

NPCC	National Pollution Control Commission
NT	Near Threatened
PCAA	Philippine Clean Air Act
PENELCO	Peninsula Electric Cooperative, Inc
PENELCO	Peninsula Electric Cooperative, Inc.
PESO	Public Employment Services Office
pH	hydrogen-ion concentration
PNB	Philippine National Bank
PNP	Philippine National Police
PNSDW	Philippine National Standards for Drinking Water
PPA	Philippine Ports Authority
PPDO	Provincial Planning and Development Office
PSA	Philippine Statistics Authority
PSP	Paralytic Shellfish Poisoning
RDen	Relative Density
REDC	Ruzena Estates Development Corporation
RFreq	Relative Frequency
SBCs	Sensitive Biological Communities
SDP	Social Development Plan
SMFI	San Miguel Food, Inc.
SO2	Sulfur Dioxide
STF	Septage Treatment Facility
TESDA	Technical Education and Skills Development
TSD	Treatment, Storage and Disposal
TSS	Total Suspended Solids
VAWC	Violation of Anti-Violence Against Women and Children
VU	Vulnerable
WQG	Water Quality Guidelines
WQG	Water Quality Guidelines

EXECUTIVE SUMMARY

PROJECT FACT SHEET

PROJECT NAME	**LUCANIN MULTI-TIER BROILER PROJECT**
PROJECT LOCATION	BRGY LUCANIN, MARIVELES, BATAAN
PROJECT AREA	146.90 HECTARES
NATURE OF PROJECT	BROILER FARM
PROJECT COST	PHP 4,803,966,948.42
PROJECT PROPONENT	**SAN MIGUEL FOODS, INC. (SMFI)**
PROPONENT'S ADDRESS	NO. 40 SAN MIGUEL AVENUE, MANDALUYONG CITY, PHILIPPINES
AUTHORIZED REPRESENTATIVE	**MR. JESUS M. MAGTIRA** Vice President- Head of Plant Expansion Projects
CONTACT DETAILS	(+632)-5317-5181
CONTACT PERSON / CONTACT DETAILS	**ENGR. EDUARDO ROMERO** CIVIL ENGINEER – STRATEGIC PROJECTS MANAGEMENT GROUP CELLPHONE NO.: 09175748438 EMAIL: EROMERO@SANMIGUEL.COM.PH
NAME OF EIA PREPARER	**BROWN & GREEN ENVIRONMENTAL SERVICES, INC. (BGESI)**
CONSULTANT'S ADDRESS	BLK. 2 LOT 8, MARIS TOWNHOMES, SAN JOSE, ANTIPOLO CITY
CONTACT PERSONS AND DETAILS	**ENGR. ELIZABETH I. LAYUG** ENVIRONMENTAL CONSULTANT DENR-EMB ACCREDITED EIS PREPARER (IPCO NO. 150) LANDLINE: (+632) 650 0463 EMAIL: BETHSIGNACIO2461@GMAIL.COM

PROCESS DOCUMENTATION

PROJECT DESCRIPTION *IEC consultation Meetings with Stakeholders*	A project description was prepared by the Proponent which includes the project information, conceptual site layout plans, and the project site boundary, which defines the coverage of the ECC application.
SCOPING MEETINGS • **TECHNICAL SCOPING MEETING** • **SITE INSPECTION**	The Project Screening and Technical Scoping meetings were held January 23, 2023 at AFAB Envi. Conference room was attended by Authority of the Freeport Area of Bataan (AFAB) representatives, SMFI and Brown & Green Environmental Services, Inc. (BGESI). Ocular inspection / site visit was conducted on February 14, 2023 with AFAB, SMFI and BGESI.
ENVIRONMENTAL IMPACT ASSESSMENT	BGESI was subcontracted by SMFI in application to prepare an Environmental Impact Statement (EIS) report for Environmental Compliance Certificate (ECC) application for the proposed SMFI Lucanin Multi-Tier Broiler Project . BGESI conducted the required technical studies for the Environmental Impact Assessment (EIA). The studies include various baseline data gathering, environmental surveys, Information Education Campaign (IEC) and social surveys. The assessment of the potential impacts of the project and proposed mitigating measures are included in the study.
PUBLIC CONSULTATION	The Public Consultation was held on ____ at ____ and was attended by the ____. Additional relevant issues and concerns that will be gathered during the public consultation will be addressed in the revision of the EIS.
SUBMISSION OF EIS TO AFAB/ECC APPLICATION	The final EIS was submitted to ____ for procedural review. It was accepted on ____________.
REVIEW OF EIS	A technical review of the EIS document followed passing the procedural review. The review was conducted by the EIARC. The first review meeting was held on ____________. The final meeting was held on ____________.
AFAB ASSESSMENT PROCESS	An assessment report will be prepared by the Environmental Impact Assessment Review Committee (EIARC) with endorsement from the AFAB.

DECISION ON ECC APPLICATION	AFAB will make a decision on the Environmental Compliance Certificate (ECC) application based on the Environmental Impact Statement (EIS), the Environmental Impact Assessment (EIA) process undertaken, and the recommendation of the EIARC.

The Environmental Impact Assessment (EIA) Study team and the role of each member is presented in **Table ES-1.** The Accountability Statements of the Proponent and the EIA preparer are shown in **Annex 2 and Annex 3** respectively.

Table ES-1
The EIA Study Team

NAME	ROLE
Elizabeth Ignacio-Layug	Team Leader / Environmental Specialist
Estephen Fortela	Terrestrial Flora and Fauna Specialist
Jessica Mae Amores	Geologist/Hydrologist/ Water Quality Specialist
Ruben Estudillo	Marine Specialist
Ronald Pahunang	Air Quality and Noise Specialist
Reindelleson Mendoza	Environmental Specialist
Juan Paulo Salino	IEC and Social Specialist
Maricel Domingo	Project Coordinator

Table ES-2 Summary of Baseline Characterization

THE LAND	o **LAND USE AND CLASSIFICATION** Based on the Comprehensive Land Use Plan (CLUP) of Mariveles for years 2017-2026, the proposed Lucanin Multi-Tier Broiler Project is under agriculture classification. However, these lots were declared as Industrial Zone by the Mariveles MPDO as Planned Unit Development Area of the CLUP/ Zoning Ordinance approved under (Sangguniang Panlalawigan) SP Resolution No. 2018 dated May 18, 2018 and the SB Resolution No. 089-2018 dated June 18, 2018 (as adoption). The Project Area does not fall within any legislated or initial component of protected areas, according to data from DENR Region III. The nearest protected areas are the Palanas Watershed and Bataan National Park, which are about 9 km and 45 km away from the project site respectively. o **GEOLOGY AND SOILS**

Lucanin is characterized by rugged and hilly terrain, with elevation ranging from sea level up to about 190 meters above sea level around the proposed broiler farm. The project area is located on the slopes of the Mount Mariveles, which is a dormant volcano that forms a prominent part of the landscape in the region.

The terrain of Lucanin is dominated by steep slopes and deep valleys, with the highest peaks found in the northern part of the area. The topography is marked by numerous small streams and rivers, including the Lucanin River, which runs through the area and eventually empties into Manila Bay. The river system is an important source of water for irrigation and domestic use in the area.

The area around Mariveles is underlain by a series of sedimentary rocks, including sandstones, shales, and conglomerates, which were deposited in shallow marine environments during the late Cretaceous period. These rocks have been uplifted and folded by tectonic forces, forming a series of ridges and valleys that characterize the topography of the region.

The predominant soil type in the Municipality of Mariveles is Antipolo Clay and Pilar.

Two (2) soil samples were obtained from the project area. As the results show, all parameters in both sampling stations fall below the favourable standards set forth by the guidelines.

- **Terrestrial Flora and Fauna**

A total of 86 species from 83 genera and 51 families of trees, shrubs, herbs, grasses and vines were observed in the proposed project area located in Brgy. Alion, Brgy. Lucanin and Brgy. Townsite in Mariveles, Bataan. In terms of habit, trees were the most represented with 42 species followed by shrubs, grasses, and vines with 19, eight (8) and six (6) species observed respectively.

Malvaceae (flowering plants) was the most represented family with 12 species. This is followed by Fabaceae (legumes, peas, and beans family) and Poaceae (monocotyledonous grass family), which were represented by 10 and seven (7) species respectively. Moraceae (mulberry and figs family), Lamiaceae (mint and sage family), Sapindaceae (soapberry family) were represented by five (5) species each.

	Overall, there were 34 wildlife species that were recorded during the survey. It comprises 26 bird species, 4 mammal species, 3 reptile species and 1 amphibian species. The sampling period coincided with the migratory season of birds. The observed weather conditions of the survey varied from sunny to overcast.
THE WATER	○ **OCEANOGRAPHY** The phytoplankton organisms obtained during this survey was dominated by diatom Skeletonema (average 2,266,748 cells/m3, or 50.66%) followed by other diatoms Chaetoceros (average 1,111,929 cells/m3, or 24.85%; Rhizosolenia (average 219,981 cells/m3 or 4.92%;) and Thalassionema (average 206,280 cells/m3 or 4.61%). Overall, the zooplankton organisms sampled were dominated by the ciliate tintinnids (average 18,886 organisms/m3 or 49.98) followed by copepod nauplius larvae (average 38,537 organisms/m3 or 20.72%, appendicularia Oikopleura (average 28,410 organisms/m3, or 15.27%; ciliate Codonellopsis (average 28,410 organisms/m3, or 10.15%. The overall marine plankton organisms in this study were dominated by phytoplankton (96.01% of the total plankton catches), while zooplankton accounted for only 3.99% which indicates that the density of the phytoplankton in the area appears sufficient to support a substantial food base. The biomass ranged widely from 1.30 to 106.22 wwt g/m2. Inter-station comparison showed Station MSB3 with the highest biomass (106.22 wwt g/m2), while Station MSB3 had the least biomass (1.30 wwt g/m2). The mean biomass value recorded for all the four (4) stations was 37.99 wwt g/m2. Results of the coral reef habitat assessment based on the present literature survey conducted indicate that there are limited coral reef areas within Manila Bay. The reefs within the Manila Bay are concentrated close to the mouth of the bay. The major reef areas are specifically found along the southern Cavite coastline in the municipalities of Ternate and Maragondon. Along the Bataan coast, reefs are found only in the municipalities of Limay (Lamao Point to Petron pier) and Mariveles (Lucanin and Alas-asin). Coral reefs are also found in Corregidor and Caballo Islands. ○ **WATER QUALITY**

	Based on the result of marine quality sampling, the true color levels of the water samples collected in this survey were at a uniform level of three (3) TCU in all marine stations; however, all these color values are way below the maximum permissible limit of 75 TCU in Class SC water. The result of groundwater quality shows that the station GW 1 was slightly below the minimum temperature mandated by DAO Class A. Its TSS value is also above the limit for both PNSDW and DAO. High TSS levels in groundwater can be caused by a variety of factors, including natural processes such as erosion and weathering of rocks and soils. High levels of rainfall can also increase TSS levels in groundwater. Anthropogenic activities such as construction, mining, and agriculture can also increase TSS levels in groundwater. These activities can lead to soil erosion, which can cause sediment to enter the groundwater
THE AIR & NOISE	o **CLIMATOLOGY** The climate at the project site belongs to Type 1. Type 1 climate has two (2) pronounced seasons, namely: dry and wet seasons. The dry season is from November to April and the wet season during the rest of the year (May to September). In the Province of Bataan, there are projected increases in air temperature in all periods under moderate and high emission scenarios. Most alarming is the increase of the warm spell duration index in all future scenarios (early, mid-, and late) from 10.8 days (baseline years) to as high as 365 days (1 year) mid and late future under moderate and high emission scenarios. o **AIR QUALITY** TSP PM10 levels ranged from 24.9 to 68.1 μg/Nm3 and 12.4 to 23.6 μg/Nm^3, respectively. PM_{10} levels in February 2023 ranged from 9.7 to 31 μg/Nm$^{3.}$ These concentrations were within the ambient guideline values set for TSP and PM_{10} at 230 and 150 μg/Nm^3, respectively. The measured ambient SO_2 and NO_2 concentrations air concentrations in the November 2021 and February 2023 sampling were all less than the ambient guideline values set at 180 and 150 μg/Nm^3, respectively. Ambient air concentrations of particulate metals (As, Cd, and Ni) were not detected in the February 2023 sampling. There were traces, however, of Zn

	(0.06 to 0.7 µg/Nm^3), Hg (0.002 to 0.006 µg/Nm^3), and 0.13 to 0.26 µg/Nm^3. Levels of Hg were all less than the guideline value of 1 µg/m^3 (annual average) for inorganic Hg vapor (WHO, 2000). In terms of the air quality indices (AQI) established by the DENR, levels of TSP, PM_{10}, $PM_{2.5}$, SO_2, and CO in the area were all in “good condition” at the time of monitoring. ○ **Noise Quality** All air quality monitoring stations have results that are within the DENR guidelines. The median of the seven highest noise readings at Stations N1 to N4 were all within the respective ambient noise standards. This suggests relatively tranquil conditions typical of rural areas, the sources of noise of which were mostly from animals and insects, people conversing, and on some occasions, passing motorcycles
THE PEOPLE	○ **Socio Economic and Demographic Profile** Based on the 2020 data of Philippine Statistics Authority, Mariveles is the most populous municipality with 149,897 total population or 17.56% of Bataan Province. The project-affected barangays, Townsite, Lucanin and Alion have a combined population of 17,781 or 11.86% of Mariveles. Barangay Townsite’s 2020 population increments to 7,203 from 6,880 in 2015 or 4.69% growth rate while Barangay Lucanin’s 2020 population increases to 7,189 from 5,169 in 2015 In terms of population change and Barangay Alion’s 2020 population increases to 3,389 from 3.264. Brgy. Lucanin has the second population growth rate in the municipality with 39.08%. ○ **Basic Services** The Mariveles Water District (MARIWAD) is the primary distributor of water in the Municipality of Mariveles. MARIWAD acquires water supply from 20 deep wells sources, seven have elevated steel tanks and one has a ground reservoir. Alternatively, the Freeport Area of Bataan (FAB), former Bataan Economic Processing Zone (BEPZ), has built its own water well. The Peninsula Electric Cooperative, Inc. (PENELCO) is the primary distributor of electric power supply to the Municipality of Mariveles and 11 other

municipalities in Bataan. Based on the PENELCO's report last December 2015, all 18 barangays have accessed to electricity. There are 77 Barangay Power Associations (BAPAs) involving 56 sitios.

About 15,716 households owned communication devices in the Municipality of Mariveles. As to the affected barangays of the project, Barangay Lucanin has 701 households with communication devices on their own and 635 households for Barangay Townsite and 512 households for Barangay Alion

- **MORTALITY AND MORBIDITY**

In 2014, there are 924 births in the Municipality wherein 479 are male and 445 are female. In 2013, the total number of deaths occurred in the municipality is 381 in which 212 are male and 169 are female. Out of 381 deaths, 30 were infant death (16 Male, 14 Female). Also, there are 5 fetal death and 2 Maternal deaths in 2013. There are 2,093 total births and 252 deaths recorded by the population of Mariveles resulting to net addition of 1,841 in the year 2015.

The leading cause of deaths in Barangay Lucanin as of September 2023 data is Myocardial Infarction (Heart Attack) with 5 number of deaths recorded, followed by Hypertensive Vascular Disease with 2 incidents recorded. Barangay Alion reported about 5 people died for old age and 3 persons died with Diabetes.

The leading disease for Barangay Lucanin is due to animal bite with 187 recorded incidents followed by Acute Respiratory Infection with about 183 reported cases. Barangay Alion reported about 107 cases with Acute Respiratory Infection, followed by animal bites with about 69 incidents. Barangay Townsite reported also about 179 cases of animal bites and with Urinary Tract Infection (UTI) with 50 cases. Other reported diseases for the three Barangays includes Hypertension, Diabetes, Tuberculosis and skin diseases

- **PUBLIC PARTICIPATION**

The Information Education Communication (IEC) Campaign for the affected barangays such as Lucanin, Alion and Townsite were conducted on February 8,2023.

A courtesy call and visitation to Davao Broiler Farm and Limay Farm were

	conducted on May 3, 2023 and May 8, 2023, respectively. The visit aims to recognize and understand the technology that the proponent will use for the propose SMFI Lucanin Multi-Tier Broiler Project . o **INITIAL PERCEPTION** The perception of each barangay to the project were gathered by recording all the sentiments and concerns raised during the open forum. For Brgy. Lucanin, some residents pointed out the potential negative effects of the Broiler Farm to the nearby communities and expressed their objection to the project. However, the Brgy. Officials requested the residents to listen and understand the explanation / presentation of SMFI. In Brgy. Alion, both the Brgy. Officials and residents expressed their objection to the project. They all raised their concerns to the potential negative impacts of the project to their community once implemented. The Brgy. Officials of Brgy Townsite is requesting for another meeting to discuss all issues raised during the open forum and resolve it. They are also assessing the positive impacts of the project to their communities once implemented.
KEY ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	The key physical environmental aspects, potential impacts and applicable measures were identified and are tabulated by project phases. **Tables ES-3** and **ES-4** show the potential impacts of the project and proposed mitigation measures.

Table ES- 3 Impact Management Plan (IMP) for Lucanin Multi-Tier Broiler Project

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
I. Pre-Construction Phase						
	The Land					
Clearing of vegetation for initial access roads and facilities	Terrestrial flora	Decrease in flora cover; Loss of vegetation; Biodiversity decline	• Design the location of roads and facilities where none to minimal tree individuals will be cleared. As much as possible, avoid areas with premium, endemic and endangered species.. • Limit clearing to the proposed footprint of facilities to avoid unnecessary vegetation and habitat removal • Designate buffer zones or 'no-take' zones within the project site.	Proponent and outsourced Terrestrial Flora expert)	Php 100,000	Included in the EMoP, ECC condition
	Terrestrial fauna	Possible displacement of existing wildlife animals	• Areas to be cleared should be delineated by fences to avoid excessive removal of vegetations. Areas to be cleared of vegetation should be rehabilitated to near pre-project conditions as possible. This would entail reforestation using indigenous plant species.	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
	Land Geology, geomorphology, Geohazards	Erosion, slope failure, inducement of landslides, seismic activity, liquefaction	• Conduct necessary activities in the planning and design including slope stability and foundation studies, as well as seismic studies including site-specific peak ground acceleration (PGA) potential. • Account for the possible effects of climate change in the change in the amount of rainfall and number of days with rain.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
Generation of noise	Terrestrial fauna	Displacement of animals due to noise Affect navigation capability of birds and bats species	• Operation of high noise-emitting equipment and vehicles must be scheduled to prevent unnecessary activities. • Equipment and vehicles must be subjected to regular maintenance to minimize excessive noise	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
II. Construction Phase						
Land clearing and excavation	**The Water**					
	Plankton community	Siltation/sedimentation and turbidity which would tend to limit light penetration in the water column which is essential in phytoplankton photosynthesis; would also slightly increase mortality of fish eggs/larvae (ichthyoplankton) including other planktonic organisms. However, these impacts are insignificant and temporary	• Provision of temporary drainage canals with silt traps or basin to intercept washed out soil particles particularly in areas of excavation. • Surface run-off should be directed into a temporary ditch to allow settlement of suspended solid • Mound of soils and construction spoils should not be placed near the creek/river to avoid its movement towards the bay waters. • Filling materials should be immediately transported to the fill area and compacted to avoid its transport to the bay through runoff. • Regular disposal of construction spoil should be done to prevent accumulation in the site which could increase the possibility of its transport to the sea	Proponent's Environmental Unit/Contractor	Part of construction cost	Proponent and Contractor's MOA
Project construction activity	Soft bottom benthos	No seabed disturbance since there will be no project construction activities along the shoreline which is about 2.25 km from the poultry farm project . Therefore, there will be no any significant effect on the soft bottom benthic communities in the area	• No mitigation is needed	-	-	-
	Coral, seagrass and mangrove communities	None of these sensitive biological communities (SBCs) were found to occur in the area. Therefore, no	• No mitigation is needed	-	-	-

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
		negative impacts are predicted				
	Local fisheries	Significant impacts to fisheries resources are unlikely due to the distant location of their traditional and municipal fishing grounds/operations from the proposed broiler farm project	• No need for mitigation of impacts is required	-	-	-
	Surface water quality	Decreased water quality due to erosion and sedimentation	• Sediment Control: To prevent sediment from entering nearby water bodies, sediment control measures such as silt fences, sediment basins, and vegetation cover can be used. Implementing soil conservation practices, such as cover cropping and conservation tillage, to reduce the potential for sediment runoff. • Properly managing construction waste: Construction waste such as excess soil, concrete, and chemicals can potentially contaminate water. To prevent contamination, construction waste should be properly managed and disposed of in accordance with local regulations. • Conducting water quality monitoring: Prior to construction, water quality monitoring can be conducted to establish baseline conditions and identify any potential sources of pollution. Regular monitoring during and after construction can also help to identify and address any issues that may arise. • Implementing Best Management Practices (BMPs): BMPs can be used to manage and minimize the impact of construction activities on water quality. These may include techniques such as slope stabilization, revegetation, and stormwater management practices.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	PPart of DED / Construction Cost and Also Included in the EMoP, ECC condition
		Degradation from sewage, wastewater and solid waste	• Proper waste management: Implement proper waste management practices during construction, including proper disposal of sewage and solid waste. Ensure that waste is properly stored, collected, and disposed of in accordance with local regulations. • Install proper wastewater facilities: Install proper wastewater treatment facilities to ensure that any wastewater generated during construction is disposed of properly. • Implement erosion and sediment control measures: Implement erosion and sediment control measures to prevent soil erosion and sedimentation, which can lead to increased nutrient and bacteria levels in water bodies. • Establish buffer zones: Establish buffer zones around water bodies to prevent any potential negative impacts on water quality. • Monitor construction activities: Monitor construction activities to ensure that there are no leaks or spills of hazardous materials that could potentially contaminate water sources. • Conduct regular water quality testing: Conduct regular water quality testing to monitor for any changes in water quality, and take appropriate action if any issues are identified. • Engage with local communities: Engage with local communities and stakeholders to identify any concerns or issues related to water quality and take these into consideration in the planning process.	Proponent / Contractor	Include in TOR of Detailed Engineering Design	Part of DED / Construction Cost and Also Included in the EMoP, ECC condition
	Streamflow	Disruption of water flow	• Avoiding stream channelization: Stream channelization, or the straightening and deepening of streams, can cause changes in water flow patterns and disrupt natural habitats. To prevent this, it is important to avoid stream channelization and preserve the natural flow of streams and waterways. • Implementing erosion control measures: Construction activities can cause soil erosion, leading to sedimentation and the disruption of water flow. To prevent this, erosion control measures such as silt fences, sediment basins, and vegetation cover can be used to trap sediment and prevent it from entering nearby waterways.	Proponent / Contractor	Include in TOR of Detailed Engineering Design	Part of DED / Construction Cost

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			• Minimizing land disturbance: Minimizing land disturbance during construction can help to prevent soil erosion and minimize the potential for sediment runoff. This can be achieved by using proper excavation techniques, avoiding unnecessary grading, and limiting the use of heavy equipment. • Using BMPs for stormwater management: Best Management Practices (BMPs) can be used to manage stormwater runoff and prevent disruption of water flow. Techniques such as vegetated swales, infiltration trenches, and permeable pavements can help to slow down and filter stormwater runoff, promoting infiltration and reducing erosion. • Conducting hydrological studies: Prior to construction, hydrological studies can be conducted to evaluate the site's drainage patterns and identify any potential impacts on water flow. This can help to inform the design of stormwater management measures and ensure that water flow is maintained throughout construction.			
Transportation of materials, machineries and equipment to project site Operation and maintenance of vehicles and heavy equipment	Surface and groundwater Quality	Decreased water quality due to erosion and sedimentation	• Sediment Control: To prevent sediment from entering nearby water bodies, sediment control measures such as silt fences, sediment basins, and vegetation cover can be used. Implementing soil conservation practices, such as cover cropping and conservation tillage, to reduce the potential for sediment runoff. • Properly managing construction waste: Construction waste such as excess soil, concrete, and chemicals can potentially contaminate water. To prevent contamination, construction waste should be properly managed and disposed of in accordance with local regulations. • Conducting water quality monitoring: Prior to construction, water quality monitoring can be conducted to establish baseline conditions and identify any potential sources of pollution. Regular monitoring during and after construction can also help to identify and address any issues that may arise. • Implementing Best Management Practices (BMPs): BMPs can be used to manage and minimize the impact of construction activities on water quality. These may include techniques such as slope stabilization, revegetation, and stormwater management practices.	Proponent / Contractor	Include in TOR of Detailed Engineering Design	Part of DED / Construction Cost and Also Included in the EMoP, ECC condition
Clearing of vegetation and earth moving activities; change in land use	**The Land**					
	Terrestrial flora	• Loss of vegetation; • Loss of ethnobotanically important species; • Biodiversity decline	• Off-setting of lost vegetation through rehabilitation of suitable planting areas with native vegetation species; • Earth-balling of affected premium and endangered forest tree species (if applicable); • Regular monitoring of species composition in the baseline sites	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)	Php 75,000/monitoring period	Included in the EMoP, ECC condition
	Terrestrial fauna	• Possible displacement of existing wildlife animals	• Areas to be cleared should be delineated by fences to avoid excessive removal of vegetations. Areas to be cleared of vegetation should be rehabilitated to near pre-project conditions as possible. This would entail reforestation using indigenous plant species.	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Generation of noise	Terrestrial fauna	• Displacement of animals due to noise • Affect navigation capability of birds and bats species	• Operation of high noise-emitting equipment and vehicles must be scheduled to prevent unnecessary activities. • Equipment and vehicles must be subjected to regular maintenance to minimize excessive noise	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Excavation of soil	Terrestrial Fauna	• Dust emission may result to respiratory	• For large vehicles that expire dust and smoke, devise a routing scheme for	Proponent and outsourced	Php 100,000	Included in the EMoP, ECC

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
		impairment of wildlife animals	hauling vehicles to minimize areas to be disturbed and water should be sprinkled to minimize dust accumulation and spreading	Terrestrial Fauna expert)		condition
Disposal of waste materials such as oil from large equipment and vehicles, and garbage from personnel workers	Terrestrial Fauna	• Waste materials can be ingested by wildlife animals • Wildlife animals can be entangled by the waste materials • Released chemicals from the vehicles can be harmful to wildlife animals	• Proper waste management plan by the project proponent • Equipment and vehicles must be checked regularly to avoid generation of oil waste materials • Waste disposal should be coordinated with the project management to avoid excessive accumulation of wastes.	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Clearing, grubbing, excavation, and ground preparation Transportation of materials, machineries and equipment to project site Operation and maintenance of vehicles and heavy equipment	Land use and classification	• Change in land use and tenure	• Verify land-use assessment: Before construction begins, conduct a verification of the land-use assessment to identify the current land use and tenure status of the proposed construction site. This assessment should include consultation with local authorities and communities. • Respect existing land tenure: Respect the existing land tenure by ensuring that landowners are fairly compensated for any land use changes, and by securing the necessary permits and approvals from local authorities. • Engage with local communities: Engage with local communities and stakeholders to identify any concerns or issues related to land use and tenure status, and take these into consideration in the planning process. • Establish buffer zones: Establish buffer zones around the construction site to prevent any potential negative impacts on neighboring land uses. • Monitor construction activities: Monitor construction activities to ensure that land use and tenure status is not negatively impacted by the construction of the broiler farm.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
		• Encroachment and disturbance of ECAs	• Conduct a site assessment: Before construction begins, conduct a site assessment to identify any protected areas near the proposed construction site. This assessment should include a review of local and national laws and regulations related to protected areas. • Plan the construction carefully: Use the information from the site assessment to plan the construction activities carefully. Avoid any activities that could encroach on protected areas or cause unnecessary disturbance. • Work with local authorities: Consult with local authorities, including the Department of Environment and Natural Resources (DENR) and other relevant agencies, to ensure that all regulations and requirements related to protected areas are followed. • Establish buffer zones: Establish buffer zones around protected areas to prevent construction activities from encroaching on these areas. These buffer zones should be clearly marked and enforced throughout the construction process. • Implement environmental management practices: Implement environmental management practices during construction, such as proper waste management, erosion control measures, and sedimentation control measures. These practices can help prevent contamination and minimize the impact of construction activities on protected areas. • Monitor construction activities: Monitor construction activities to ensure that protected areas are not being encroached upon and that environmental management practices are being followed.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction
	Geohazards	• Inducement of effects of seismic activity	• Conduct a geohazard assessment: A geohazard assessment should be conducted to identify any potential geohazards in the construction site. The assessment should include an evaluation of the geology, soil conditions, topography, and other factors that can contribute to geohazards such as landslides and soil liquefaction. • Implement engineering controls: Engineering controls such as retaining walls,	Proponent/Contractor	Include in TOR of Detailed Engineering Design (DED) for	Part of DED / Construction Cost

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			slope stabilization measures, and ground reinforcement techniques can be implemented to prevent landslides and other slope failures. Soil nailing, anchoring, and geotextiles are some examples of ground reinforcement techniques that can be used. • Avoid areas prone to flooding: Construction activities can cause sedimentation and erosion, which can affect the natural flow of water and increase the risk of flooding. To mitigate this, it is important to avoid areas prone to flooding and ensure that proper stormwater management measures are in place. • Implement proper site drainage: Proper site drainage is critical in preventing soil erosion and surface runoff. Drainage systems such as swales and sediment basins can be used to capture sediment and filter runoff. • Monitor construction activities: Monitoring construction activities is essential to ensure that proper mitigation measures are being implemented and that geohazards are being managed effectively.		Construction	
	Soil	• Loss of topsoil	• Whenever possible, convert topsoil and suitable dredge spoils for backfilling and landscaping within the project area.	Project proponent/ contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
		• Soil Erosion	• Implementing erosion control measures: Erosion control measures such as silt fences, sediment basins, and vegetation cover can be used to prevent soil erosion and protect nearby water resources.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
		• Soil Contamination	• Properly storing construction materials: Construction materials such as concrete, lumber, and soil can potentially contaminate soil. To prevent contamination, these materials should be stored properly and away from sensitive areas. • Minimizing land disturbance: Minimizing land disturbance during construction can help to preserve soil structure and minimize the potential for soil contamination. This can be achieved by using proper excavation techniques, avoiding unnecessary grading, and limiting the use of heavy equipment. • Properly managing construction waste: Construction waste such as excess soil, concrete, and lumber can potentially contaminate soil. To prevent contamination, construction waste should be properly managed and disposed of in accordance with local regulations. • Conducting soil testing and monitoring: Regular monitoring during and after construction can also help to identify and address any issues that may arise.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost and Included in the EMoP, ECC condition
	The Air					
Construction of project facilities and access roads	Air	• Increase in fugitive/ dust and gaseous emission	• Use, where possible, of water for control of dust from construction and quarrying or clearing of lands; • Setting up wheel washing facilities at the construction site, particularly during rainy or wet seasons. • Impose speed limits within the construction site and along access roads • Limit construction works during arid and windy conditions, mainly when dust is visibly dispersed outside the project site, • Use wind erosion measures (e.g., windbreakers) and cover storage piles, if necessary,	Project proponent/ contractor	PhP 50,000 per month	Part of construction cost

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			• Prevent possible spillage of materials along roads by providing the appropriate cover of haul materials in the truck, • Limit the idling of vehicles as much as possible to minimize the release of air pollutants. The recommended idling time is no more than three minutes while parking or stopping, though engines may idle when necessary, such as cement mixers and content delivery equipment (Source: www.doee.dc.gov), • Develop and implement an effective traffic management plan for continuous traffic flow, thereby reducing fuel consumption and tailpipe emissions, and • Maintenance of the heavy equipment, vehicles, and other construction equipment following the manufacturer's specifications and legal requirements			
Construction of project facilities and access roads	Noise	• Increase in noise levels	• Include Noise Mitigation Plan in the contractor's contract. Include compliance certificate. • Limit use of heavy equipment at nighttime, especially equipment that emits high noise level • Enclose high noise emitting equipment with temporary barriers and sound absorbing materials, when necessary. • Install adequate or appropriate mufflers at tailpipes of mobile equipment and generator sets • Reduce the number of operating equipment, particularly during nighttime and early morning/evening periods, if construction during nighttime will result in excessive noise at nearby noise-sensitive receptors; • Strictly impose speed limits on access roads and within the project area. • Provision partial or total enclosure of high noise sources, when necessary	Project proponent/ contractor	PhP 50,000 per month	Part of construction cost
	The People					
Construction of project facilities and access roads	Health and Safety	Risk on health and safety of the workers as well as the neighboring community	• Develop and implement a Construction Health and Safety Program • Establish and implement a solid waste management program • Close coordination with Barangay Local Government Units for any complaints (Complaints registry) • Residual wastes and hazardous wastes will be collected and transported to AFAB accredited landfill and/or treatment facilities by licensed waste transporters • Implementation of safe work methods and practices • Compliance to National Standards, local regulations and laws	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA
	Quality of Life: Health Services,Water Availability, and Sanitation	Disruption and/or competition indelivery of basic services and goods	• Provide housing and utilities for workers. • Ensure that contractor practice sustainable use of water. • Provide an Occupational Safety & Health Program for all employess and contractors • Close coordination with community leaders in promoting peace and order and acceptable lifestyle.	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA
	Quality of Life: Livelihood Opportunities	Generation of local employment. Increase in income for local residents and the LGUs. Increase in livelihood opportunities.	• Design and implement a robust "local first" hiring policy of q ualified applicants. • Observe no preference in terms of gender and race during the hiring process. • Source out other necessary consumable materials such as food from the community, people's organization, and/or farmers. • Provide livelihood trainings, as part of the SDP, to project-affected communities in preparation to the forthcoming opportunities.	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA
	Quality of Life:	Traffic Congestion	Prevent possible traffic congestion by implementing the following: • Plan logistic movement of equipment to avoid high density traffic areas and use	Project proponent/ contractor	Part of construction	Proponent and Contractor's

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
	Transportation Network		of alternate routes; • Schedule hauling and movement of construction vehicles by avoiding peak hour traffic such as 11 PM to 5 AM (from Manila) and to 8 PM to 6 AM (from Bataan) • Assign traffic personnel to ensure normal flow of vehicles particularly at intersections; • Conduct detailed traffic survey/route alignment to determine optimum route and schedule.		cost	MOA
II. Operational Phase						
Sewage and wastewater generation from various sources, including storm water and run-off from land	**The Water**					
	Plankton community	Will eventually end up in the nearshore marine waters of Lucanin (through the Amo River and Lucanin River)	Will develop the necessary infrastructure in the area of sewage and wastewater management to make the proposed broiler farm project sustainable.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
		Water pollution with nitrate and pathogenic phosphate (usually fecal germs and Salmonella) is the main cause for concern in the case of poultry farming. Marine plankton communities can be negatively affected by the presence of these pollutants. Phytoplankton red tide organisms or HABs require nitrogen and phosphorus for their rapid growth, or bloom	Liquid wastes should be directed to a planned water treatment plant facility to ensure that coastal waters will be free from biological and bacteriological contaminants (liquid waste must be treated before it is released into the environment to prevent any harm or risk it may have on the environment and human health). Appropriate treatment will be employed so that the final effluent would meet the DENR water quality standards. Plankton monitoring/examination should be directed at screening for the occurrence of phytoplankton "red tide" organisms or other harmful algal bloom species.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Surface and groundwater Quality	Degradation of water quality due to increased sewage, wastewater and solid waste from workers	Storm water should be diverted to the storm drains/canals (discharge points to be checked and inspected on a weekly basis for any sign of contamination before it will be discharged to the aquatic environment) • Implementing best management practices (BMPs) for nutrient and waste management, including proper storage and disposal of manure and other waste products. • Reducing the use of antibiotics and other chemicals that could potentially leach into surface water sources. • Regular monitoring of surface water quality to identify and address any potential issues in a timely manner.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
Clearing of vegetation and earth moving activities; change in land use	**The Land**					
	Terrestrial flora	Biodiversity decline (decrease in species richness and abundance)	• Off-setting of lost vegetation through rehabilitation of suitable planting areas with native vegetation species; • Regular monitoring of species composition in the baseline sites; inclusion of flora protection programs in the IEC of the proponent.	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora	Php 75,000/monitoring period	Included in the EMoP, ECC condition

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
				expert)		
Accumulation of fecal matter from the poultry farm that can contaminate the nearby habitats such as the river system	Terrestrial Fauna	• Water pollution to the nearby river system • Disease transmission such as parasites from fecal matters to wildlife animals • Ingestion of toxic materials from fecal matters	Provision and construction of Waste water handling and treatment facilities such as • Anaerobic Baffled Reactor with Constructed Wetland - domestic wastewater coming from sanitary facilities of integrated building of different farmhouses will be treated via series of baffles along the treatment chamber • Wastewater Lagoon - wastewater discharge from the seasonal cleaning of houses will be treated via series of lagoons : Facultative, Aerobic, Maturation Pond and Engineered Wetlands • Sewage Treatment Plant - domestic wastewater from the ancillary building will be treated in a STP	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Operations of the broiler farm	Soil	Soil Contamination	• Implementing proper waste management: Proper management of waste is crucial to prevent the accumulation of waste products that can lead to soil contamination. Best management practices (BMPs) for waste management may include proper storage and disposal of manure and other waste products, composting, and the use of waste management systems such as lagoons or anaerobic digesters. • Using chemical inputs responsibly: The use of chemicals such as antibiotics, disinfectants, and pesticides can potentially contaminate soil. To reduce the potential impact of these substances on soil quality, it is important to use them responsibly and in accordance with recommended application rates and practices. • Implementing soil conservation practices: Soil conservation practices such as cover cropping, conservation tillage, and crop rotation can help to improve soil quality, reduce erosion, and maintain soil health. • Regular soil testing and monitoring: Regular soil testing and monitoring can help to identify potential issues with soil quality and allow for timely interventions to prevent contamination or degradation. • Engaging in responsible land use practices: Responsible land use practices such as minimizing land disturbance, reducing runoff, and avoiding soil compaction can help to maintain soil structure and prevent soil degradation.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	The Air					
Poultry farm operation (manure management, dead chicken disposal, etc.)	Air Quality	Odor nuisance	• Ensure that mechanical interventions at all points of entry and adequate ventilation to keep manure dry. • Implement a proper waste management to minimize or avoid odor nuisance that will arise • Regular maintenance of ventilation fans and other equipment • Ensure regular Collection of manure and proper handling and treatment. Collection of manure should be within time interval of 24 hours • Regular housekeeping of facilities	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Noise	Increase in noise levels	• Install adequate or appropriate mufflers at tailpipes of mobile equipment and generator sets • Strictly impose speed limits on access roads and within the project area.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	The People					
Operations of the broiler farm	Health and Safety	Risk on health and safety of the workers as well as the neighboring community	• Develop and implement an Environment ,Health and Safety Program • Establish and implement a solid waste management program • Close coordination with Barangay Local Government Units for any complaints (Complaints registry)	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			• Residual wastes and hazardous wastes will be collected and transported to AFAB accredited landfill and/or treatment facilities by licensed waste transporters Implementation of safe work methods and practices Compliance to National Standards, local regulations and laws			
	Multiplier effect and improvement of local /regional economy	Increase in employment opportunities and improvement quality of life	• Apply the “Local First” Hiring Policy for qualified personnel, wherever applicable • Observe no preference in terms of gender, religion and ethnicity during the hiring process • Source out other necessary consumable materials such as food from the community, people’s organization, and/or farmers. • Provide livelihood trainings, as part of the SDP, to project-affected communities in preparation to the forthcoming opportunities.	Proponent’s Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Quality of Life: Transportation Network	Traffic Congestion	• Prevent possible traffic congestion by implementing the following: • Plan logistic movement of equipment to avoid high density traffic areas and use of alternate routes; • Schedule hauling and movement of trucks by avoiding peak hour traffic • Assign traffic personnel to ensure normal flow of vehicles particularly at intersections; • Conduct detailed traffic survey/route alignment to determine optimum route and schedule.	Proponent’s Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
III. Abandonment Phase						
Removal of broiler farm facilities	**The Water**					
	• Plankton and benthos communities and local fisheries	• No negative impacts are predicted	• No mitigation is needed			
	• Surface and groundwater Quality	• Degradation of water quality due to increased sewage, wastewater	• Proper waste disposal: Ensure that all waste generated during decommissioning is properly disposed of, including any sewage and solid waste. Follow local regulations and guidelines for waste disposal to prevent contamination of water sources. • Site cleanup: Conduct a thorough site cleanup after decommissioning, including removal of any remaining waste or debris. This will prevent any potential negative impacts on water quality and other environmental resources. • Restoration of the site: Restore the site to its natural state after decommissioning, including the removal of any buildings, structures, or equipment. This will minimize the impact on the surrounding environment and prevent any long-term negative impacts on water quality. • Water Quality monitoring: Monitor surface and groundwater quality around the site after decommissioning to ensure that there are no negative impacts on water quality. If any issues are identified, appropriate action should be taken to address them. • Community engagement: Engage with local communities and stakeholders during decommissioning to identify any concerns or issues related to water quality, and take these into consideration in the planning process.	Proponent’s Environmental Unit/Contractor	Part of Abandonement Cost	Included in the ECC condition
	The Land					
	Soil	Soil contamination	• Soil testing: Conduct soil testing before decommissioning to identify any potential	Proponent’s	Part of	Included in the ECC

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			contamination that may need to be addressed. If contamination is identified, appropriate measures should be taken to remediate the soil before decommissioning. • Proper waste disposal: Ensure that all waste generated during decommissioning is properly disposed of, including any soil that may be contaminated. Follow local regulations and guidelines for waste disposal to prevent contamination of soil and water sources. • Site cleanup: Conduct a thorough site cleanup after decommissioning, including removal of any contaminated soil. This will prevent any potential negative impacts on soil quality and other environmental resources. • Restoration of the site: Restore the site to its natural state after decommissioning, including the removal of any buildings, structures, or equipment. This will minimize the impact on the surrounding environment and prevent any long-term negative impacts on soil quality. • Monitoring: Monitor soil quality around the site after decommissioning to ensure that there are no negative impacts on soil quality. If any issues are identified, appropriate action should be taken to address them. • Community engagement: Engage with local communities and stakeholders during decommissioning to identify any concerns or issues related to soil quality, and take these into consideration in the planning process.	Environmental Unit/Contractor	Abandonement Cost	condition

Table ES- 4 Proposed Environmental Monitoring Plan (EMoP) for the Lucanin Multi-Tier Broiler Project

Module	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling and Measurement			Lead Person	Annual Estimated Cost	EQPL Management Scheme[1]					
								EQPL Range			Management Measure		
			Methods	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
I. PRE- CONSTRUCTION PHASE													
Land	Terrestrial Flora	Biodiversity indices, species richness and abundance	Belt-transect method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Proponent and Outsourced Terrestrial Flora expert)	Php 100,000/sampling	-	-	-	-	-	-
	Terrestrial Fauna	Biodiversity indices, species richness and abundance	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Proponent and Outsourced Terrestrial Fauna expert)	Php 100,000/sampling	-	-	-	-	-	-
II. CONSTRUCTION PHASE													
Land	Terrestrial Flora	Biodiversity indices, species richness and abundance Occurrence and or counts of premium or native species	Belt-transect method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)	Php 75,000/monitoring period	10% decline in species composition with reference to baseline data or ranges can be identified by the MMT	30% decline in species composition with reference to baseline data or ranges can be identified by the MMT	50% decline in species composition with reference to baseline data or ranges can be identified by the MMT	Enhance maintenance and protection activities in the buffer zones	Rehabilitation of suitable planting areas with native tree species	Rehabilitation of suitable planting areas with native tree species with enhanced maintenance and protection activities to ensure higher plantation survival rate
	Terrestrial Fauna	Biodiversity indices, species richness and abundance; presence of absence of important native and endemic wildlife species	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	MMT; Environmental Officer; Outsourced Terrestrial Fauna expert	Php 100,000/sampling	10% decline in species composition with reference to baseline data	30% decline in species composition with reference to baseline data	50% decline in species composition with reference to baseline data	Continue monitoring; Determine the cause of decrease in species population	Continue monitoring; Determine the cause of decrease in species population; Coordinate with	Continue monitoring; Determine the cause of decrease in species population; Coordinate with

[1] *EQPL-Environmental Quality Performance Levels based on DAO 2003-30*

Module	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling and Measurement			Lead Person	Annual Estimated Cost	EQPL Management Scheme[1]					
								EQPL Range			Management Measure		
			Methods	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
												MMT	MMT; Determine which parameters near the limit
Water	May tend to limit light penetration which is essential in photosynthesis/plank-ton production, and may lead to irritation and clogging of gills of pelagic fish larvae/juveniles due to siltation/sedimenta-tion and increased turbidity from land clearing and excavation	Plankton species composition, richness, abundance and biomass	Plankton net sampling	Semi-annual	Nearshore (closer to river mouths) and offshore	PCO/Environ-mental Officer	50,000	80-100% decline in baseline data on species composition, richness, abundance and biomass	30% decline in baseline data on species composition, richness , abundance and biomass	50% decline in baseline data on species composition, richness, abundance and biomass	Investigate whether the decline is project-related or non-project related	If project related then inform concerned department/pro-ject management. If not project related, then inform MMT, LGU and DENR	If project related, evaluate existing mitigation measures being implemented. Implement a more effective mitigation measure as necessary. If not project related, then inform MMT, LGU and DENR for proper action
	Water Quality	TSS	Grab Sampling	Monthly	Baseline Stations	Contractor	10,000/month	-	-	-	-	-	-
		pH, BOD, Temp, DO, chloride, fecal coliform, nitrate, phosphate, color, oil and grease	Grab Sampling	Quarterly	Baseline Stations	Contractor	100,000 per quarter	-	-	-	-	-	-
Air and Noise													
	Increase in fugitive/ dust and gaseous emission	Ambient TSP, PM_{10}, SO_2, and NO_2	TSP– High volume-Gravimetric, USEPA 40 CFR, Part 50 PM_{10}- High volume with 10 micron particle-size inlet-Gravimetric, USEPA 40 CFR, Part 50, Appendix J SO_2 – Gas Bubbler -	Quarterly or as frequent as necessary	Project boundary and nearest residences	Project proponent/ contractor	PhP 50,000 per month	≥75% of ambient standard. EQPL (Alert Mininum in µg/Nm³) NO_2 = 195 TSP = 225 PM_{10} = 150 SO_2 =255	≥ 90% of ambient standard. EQPL (Action minimum in µg/Nm³) NO_2 = 234 TSP = 270 PM_{10} = 180 SO_2 =306	NAAQS (in µg/Nm³) NO_2 = 260 TSP = 300 PM_{10} = 200 SO_2=340	Monitor levels and determine prevailing wind flows and other meteorological condition Identify possible sources of high ambient concentrations	Check for complaints from residence Implement mitigation measures to reduce fugitive emissions during construction (e.g., water spraying) Inform management in case the proposed project	Suspend construction related work that causes exceedance with ambient levels (e.g., TSP) and implement corrective measure (e.g., water spraying)

Module	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling and Measurement			Lead Person	Annual Estimated Cost	EQPL Management Scheme[1]					
								EQPL Range			Management Measure		
			Methods	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
			Pararosaniline Method NO_2- Gas Bubbler-Griess Saltzman Method or Chemiluminescence Method									is the possible source of high ambient levels based on meteorological condition	
	Increase in noise levels	Noise Levels	Direct reading/sound level meter	Quarterly (or as frequent as necessary) (depends if there are complaints from nearby residents)	Residences and other noise sensitive receptors adjacent construction sites	Proponent	Included in air monitoring	Post-ECC agreement	Post-ECC agreement	NPCC (1980) ambient noise standard: a) Class A-Residential - Daytime= 55 dBA -Evening/ morning = 50 dBA -Nighttime =45 dBA	Check background noise levels	Check sources of noise that contribute to higher noise levels	Implement noise attenuation measures
		Vehicles, machineries	Operates equipment, machines according to manufacturer's instruction. Limit operations of loud equipment during daytime (as much as it is practical) Regular inspection and maintenance of equipment machineries Provision and use of appropriate PPE Review complaint register	Monthly	Number and details of noise complaints	Proponent	Included in air monitoring	-	-	-	-	-	-
People	Employment opportunities	No. of locally- hired worker during construction stage (skilled and unskilled);	Actual count/ interview	Monthly	Project Site	Contractor's Safety Officer	-	-	-	-	-	-	-

Module	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling and Measurement			Lead Person	Annual Estimated Cost	EQPL Management Scheme[1]					
								EQPL Range			Management Measure		
			Methods	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
	Hazard to Workers	Implementation of safe work methods and practices	Observation/ occurrence	Daily	Project Site	Contractor's Safety Officer	300,000	-	-	-	-	--	-
	Health and safety of workers	Implementation of COVID-19 safety protocol	Actual count of active cases	Weekly	Project Site	Contractor's Health and Safety Officer	300,000	-	-	-	-	-	-
III. OPERATION PHASE													
Land	Terrestrial Flora	Biodiversity indices, species richness and abundance Occurrence and or counts of premium or native species	Belt-transect method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)	Php 75,000/monitoring period	10% decline in species composition with reference to previous monitoring data or ranges can be identified by the MMT	30% decline in species composition with reference to previous monitoring data or ranges can be identified by the MMT	50% decline in species composition with reference to previous monitoring data or ranges can be identified by the MMT	Enhance maintenance and protection activities in the buffer zones	Rehabilitation of suitable planting areas with native tree species	Rehabilitation of suitable planting areas with native tree species with enhanced maintenance and protection activities to ensure higher plantation survival rate
		Growth Performance and Survival Rate of planted native tree species	Height and diameter measurement; counting of survived planted seedlings	Semi-annual	Suitable planting/rehabilitation areas	Environmental Officer; Outsourced Terrestrial Flora expert	Php 100,000. (*varies depending on the hectarage and type of planted species*)	>90% survival rate	85-90% survival rate	<85% survival rate	Continue the implementation and establishment of rehabilitation areas	Enhance maintenance and protection activities	Replanting with appropriate native tree species
	Terrestrial Fauna	Biodiversity indices, species richness and abundance; presence of absence of important native and endemic wildlife species	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	MMT; Environmental Officer; Outsourced Terrestrial Fauna expert	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	10% decline in species composition with reference to baseline data	30% decline in species composition with reference to baseline data	50% decline in species composition with reference to baseline data	Continue monitoring; Determine the cause of decrease in species population	Continue monitoring; Determine the cause of decrease in species population; Coordinate with MMT	Continue monitoring; Determine the cause of decrease in species population; Coordinate with MMT; Determine which parameters near the limit
Air	Odor nuisance	Odor	Complaints registry – number	Every 2 weeks	Nearby residents	PCO	Part of PCO task	-	-	-	-	-	-

MODULE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETERS TO BE MONITORED	SAMPLING AND MEASUREMENT			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME[1]					
								EQPL RANGE			MANAGEMENT MEASURE		
			METHODS	FREQUENCY	LOCATION			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
			and details of odor and other complaints										
People	Employment opportunities	No. of locally- hired worker during construction stage (skilled and unskilled);	Actual count/ interview	Monthly	Project Site	SMFI's Safety Officer	-	-	-	-	-	-	-
	Hazard to Workers	Implementation of safe work methods and practices	Observation/ occurrence	Daily	Project Site	SMFI's Safety Officer	300,000	-	-	-	-	-	-
	Health and safety of workers	Implementation of COVID-19 safety protocol	Actual count of active cases	Weekly	Project Site	SMFI's Safety Officer	300,000	-	-	-	-	-	-
Water	Proliferation of harmful algal species or phytoplankton toxic "red tide" due to nutrient (nitrogen and phosphorous) enrichment of coastal waters	Species composition and abundance of phytoplankton "red tide" organisms or harmful algal blooms (HABs)	Phytoplankton net sampling and microscopic examination of causative dinoflagellate organisms	Semi-annual	Nearshore (closer to river mouths) and offshore	PCO/Environ-mental Officer	50,000	70-100% proliferation of phytoplankton dinoflagellate species causing red tide in the plankton samples	40% proliferation of phytoplankton dinoflagellate species causing red tide in the plankton samples	10% proliferation of phytoplankton dinoflagellate species causing red tide in the plankton samples	Investigate whether the prolifera-tion is project-related or non-project related. If "red tide" occurrence is not project related, then immediate-ly inform MMT, LGU/BFAR and DENR for p0roper action	If project related then inform concerned department/pro-ject management. If not project related, then immediately inform MMT, LGU/BFAR and DENR	If project related, evaluate existing mitigation measures being implemented. Implement a more effective mitigation measure as necessary. If not project related, then inform MMT, LGU, BFAR and DENR for proper action
	Water Quality	TSS	Grab Sampling	Monthly	Baseline Stations	Contractor	10,000 / month	-	-	-	-	-	-
	Water Quality	pH, BOD, Temp, DO, chloride, fecal coliform, nitrate, phosphate, color, oil and grease	Grab Sampling	Quarterly	Baseline Stations	Contractor	100,000 per quarter	-	-	-	-	-	-

1 PROJECT DESCRIPTION

1.1 PROJECT DESCRIPTION

SMFI is proposing to build a Multi-Tier Broiler Farm in Brgy. Lucanin, Mariveles, Bataan. The Broiler Farm has an estimated total land area of 1,469,017 sqm (Phase 1). The project components consist of Admin/ Quarter's Area, Composting Facility/ MRF, Truck Marshalling Area and Eight Modules. Each Modules will have three to five houses and each house can accommodate 80,000 birds. The total capacity of the seven modules can accommodate 2,800,000 birds **Figure 1-2** shows the proposed project layout.

The Project Area is in Lucanin Industrial Estate, managed by Ruzena Estates Development Corp (REDC) which is situated within the jurisdiction of the Freeport Area of Bataan (FAB) (**Figure 1-1**) The FAB is 90.6km away from Subic Freeport, a short one-hour drive. Clark Freeport is 117km away from the FAB, a quick hour and a half trip by land. It takes less than 20 minutes to travel by air to these freeports from FAB.

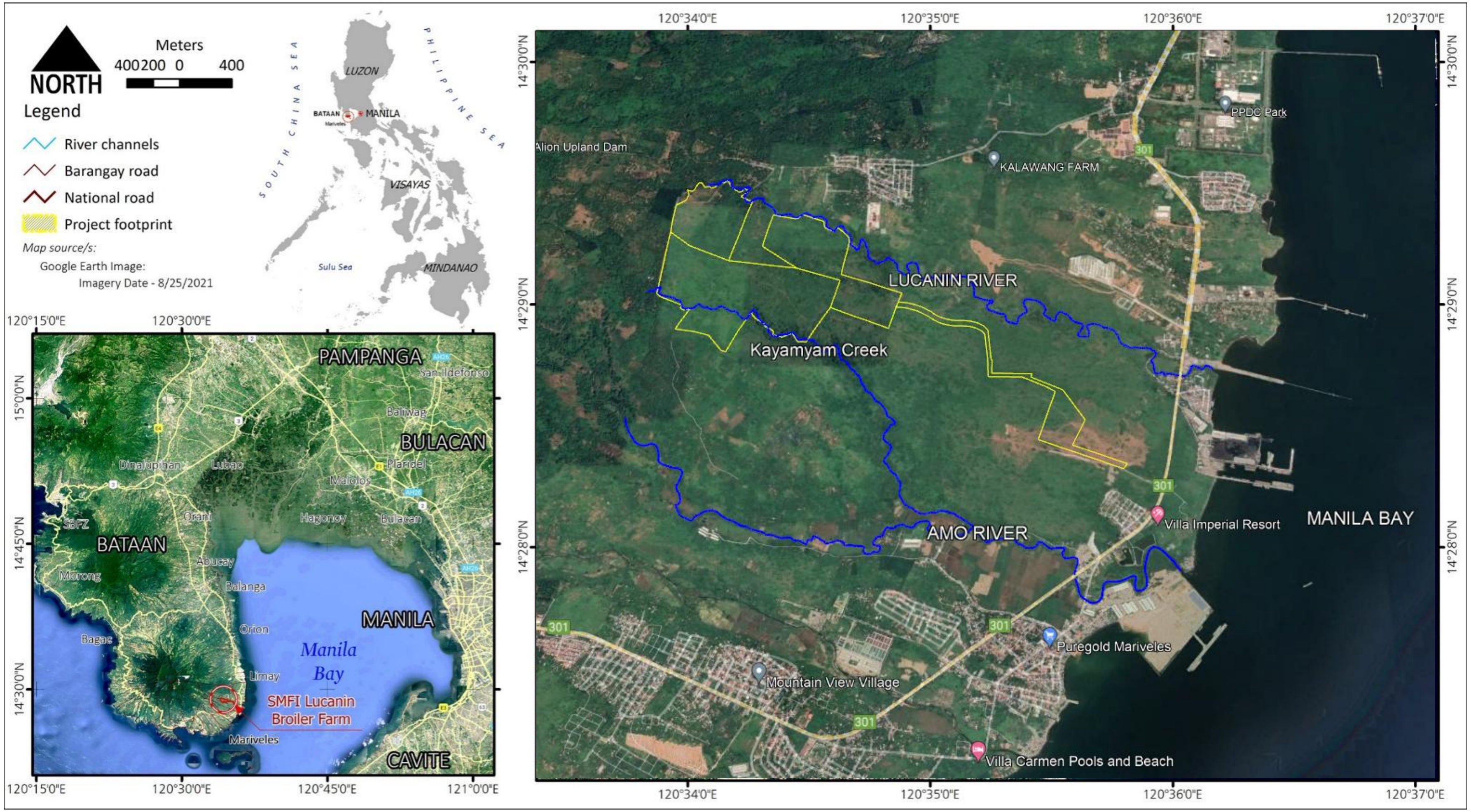


Figure 1-1 Location Map of the Proposed Project Site

Figure 1-2 Project Site Development Plan

1.1.1 Rationale for the Selection of the Primary and Secondary Impact Areas

Direct Impact Areas (DIA)

The Direct Impact Areas of the project in terms of biophysical impact during the construction and operation is the project footprint of the project which is about 146.9 hectares. This impact is due to the construction of modules, facilities, roads, and Material Recovery Facility (MRF), Composting Facility and other ancillary buildings.

Indirect Impact Areas (IIA)

The secondary impact areas or Indirect Impact Areas (IIA) that may be potentially affected by the project if not properly mitigated or managed properly are the neighboring barangays Alion, Lucanin and Townsite. These barangays will also be the priority recipient of employment and social development programs.

1.1.2 Accessibility of the Project Site/Area

The Project Site can be accessed via the Bataan Provincial Highway. It can also be accessed via sea through the Manila Bay. The project area can be both accessed via land and sea as presented in **Figure 1-3** and **Figure 1-4**.

Figure 1-3
Accessibility of the Project Area via Land

Figure 1-4
Accessibility of Project Area via Sea

1.2 PROJECT RATIONALE

San Miguel Foods Inc (SMFI) is engaged in the production of commercial feeds, poultry, pork, and beef with leading market shares in each of these industry segments.

The Proponent plans to construct a Multi-Tier Broiler Farm to address the increasing demand of basic and processed chicken products in Bataan and nearby provinces. SMFI aims to utilize state-of-the art technology that will promote efficient and environment-friendly ways of broiler production. It will provide new opportunities and harness available resources in the locality such as manpower, feeds raw materials and services.

Corporate Social Responsibility

Barangays Alion, Lucanin, Townsite and Mariveles Municipality will benefit from the Corporate Social Responsibility (CSR) programs of Ruzena Estates Development Corporation (REDC), through SMFI which includes livelihood and community programs, knowledge through learnings by offering Technical Skill Training/ Vocational Courses and Feeding Program in Day Care Centers. REDC will also do Medical and Dental Mission, conduct Coastal and River Clean up.

1.3 PROJECT ALTERNATIVES

SMFI has selected the Project site because it is accessible. Since all roads leading to the Project site are already concrete-paved and can easily be travelled by all types of land vehicles, this will facilitate easier transport of raw materials and delivery of the broilers to the processing plant.

The cost effectiveness of establishing the project in the area brought about by the increasing demand for poultry products in the area and nearby regions factored in the site assessment. The value returned to the Proponent for the investments to be made, the contributions to the local governments and other stakeholders, including contributions to social development and management, environmental protection and enhancement, and safety and health were also considered.

The consistency with natural resources plans and policies, and environmental regulations that guide the affected communities and the relatively stable peace and order situation in the choice area were taken into consideration. Hence, the Proponent considered no other alternatives than the proposed location in Barangay Lucanin, Mariveles, Bataan. The Mutli- Tier Colony System technology was also chosen over the conventional Floor Type System because of its many advantages and this technology ensures NO Fly infestation and NO foul odour build up.

1.3.1 Advantages of Multi-Tier Colony System over Floor Type System

SMFI will employ the technology of a multi-Tier Colony system that ensures No Fly infestation, automatic manure collection and no toxic odor (foul odor) generation and build up. The Multi-Tier system's many advantages over the conventional floor type system are tabulated in **Table 1-1**.

Table 1-1 Comparison between CCS3-Floor Type Multi-Tier Colony System

System	CCS3-Floor Type	Multi-Tier Colony System
Building Features	√Totally closed, Litter type √CCS with tunnel Ventilation √Automatic Feeder √Automatic nipple drinker √Computerized / PLC controller √Space heater or infra-red (spot brooding) √Silo with load cell for bulk feeds delivery ▪With elevated plastic slat flooring ▪Chicken manure drops on the floor ▪Manual harvesting ▪Capacity – 36,000 birds per house	✓ Totally closed, Colony type ✓ CCS with tunnel Ventilation ✓ Automatic Feeder ✓ Automatic nipple drinker ✓ Computerized / PLC controller ✓ Space heater (diesel) for brooding ✓ Silo with load cell for bulk feeds delivery ✓ With plastic slat flooring per tier ✓ With automated manure conveyor per tier ✓ Chicken manure collected via conveyor daily ✓ Automatic harvesting ✓ 80,000 birds per house
Manure Collection and Management	▪Manual removal after harvest (32-33days) ▪Manure accumulates on the floor ▪Damp and wet concrete flooring ▪Bagged and sell as fresh manure ▪Use insecticides (larvaecides / adulticide)	✓ Automatic collection daily ✓ Conveyor below each tier collects manure for transfer to composting facility ✓ Dry and clean concrete flooring ✓ Processed manure into fertilizer
Fly Control	▪ Ammonia build-up on damp wet floor ▪ Accumulated manure serves as breeding ground of flies ▪ Use insecticides (larvaecides / adulticide to mitigate propagation of flies	✓ Zero (0) FLY infestation. ✓ No breeding ground for flies ✓ Clean and dry flooring prevent flies to propagate

System	CCS3-Floor Type	Multi-Tier Colony System
		✓ Preventive rather than corrective
Odor Control	▪ Ammonia build-up on damp wet floor ▪ Partial AEROBIC decomposition of manure produces foul odor. ▪ Regular use of deodorant ▪ (Wipeout/Odorase) to eliminate ammonia and foul odor, neutralize harmful bacteria and biodegradation of organic waste.	✓ Clean and dry flooring prevents ammonia build-up. ✓ No toxic odor generation ✓ Preventive rather than corrective

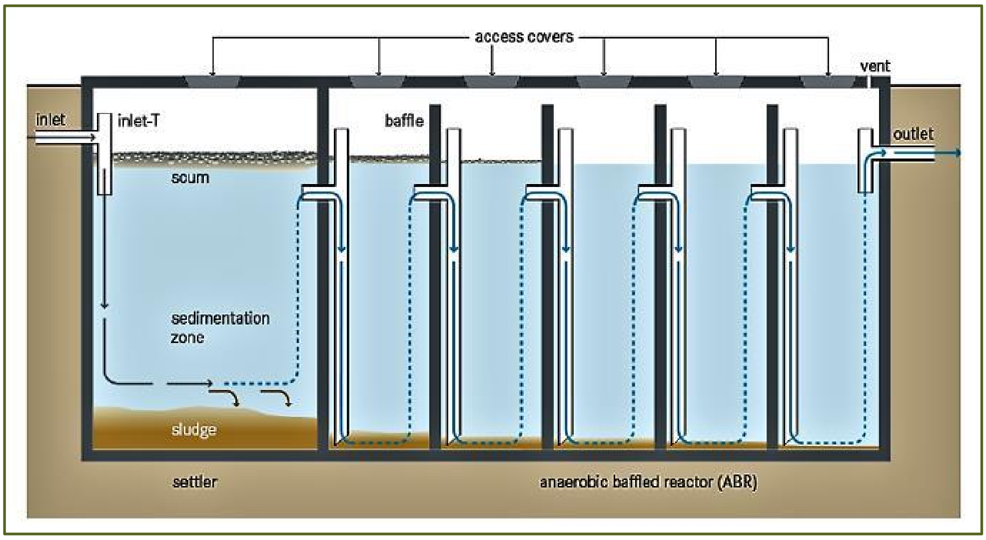
1.4 SITE SELECTION

At present there are no alternative locations being considered aside from the proposed location in Brgy. Lucanin, Mariveels, Bataan.

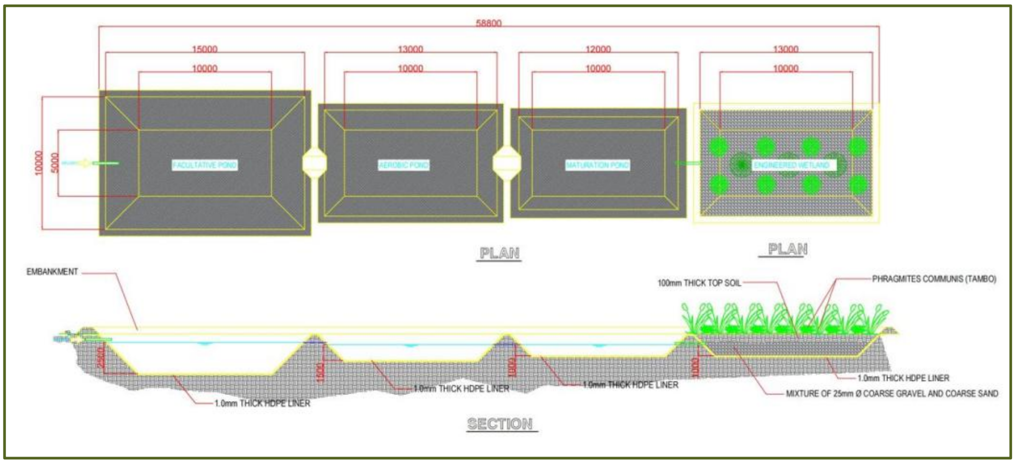
1.5 PROJECT COMPONENTS

The major components of the SMFI Lucanin Multi-Tier Broiler Project include the following:

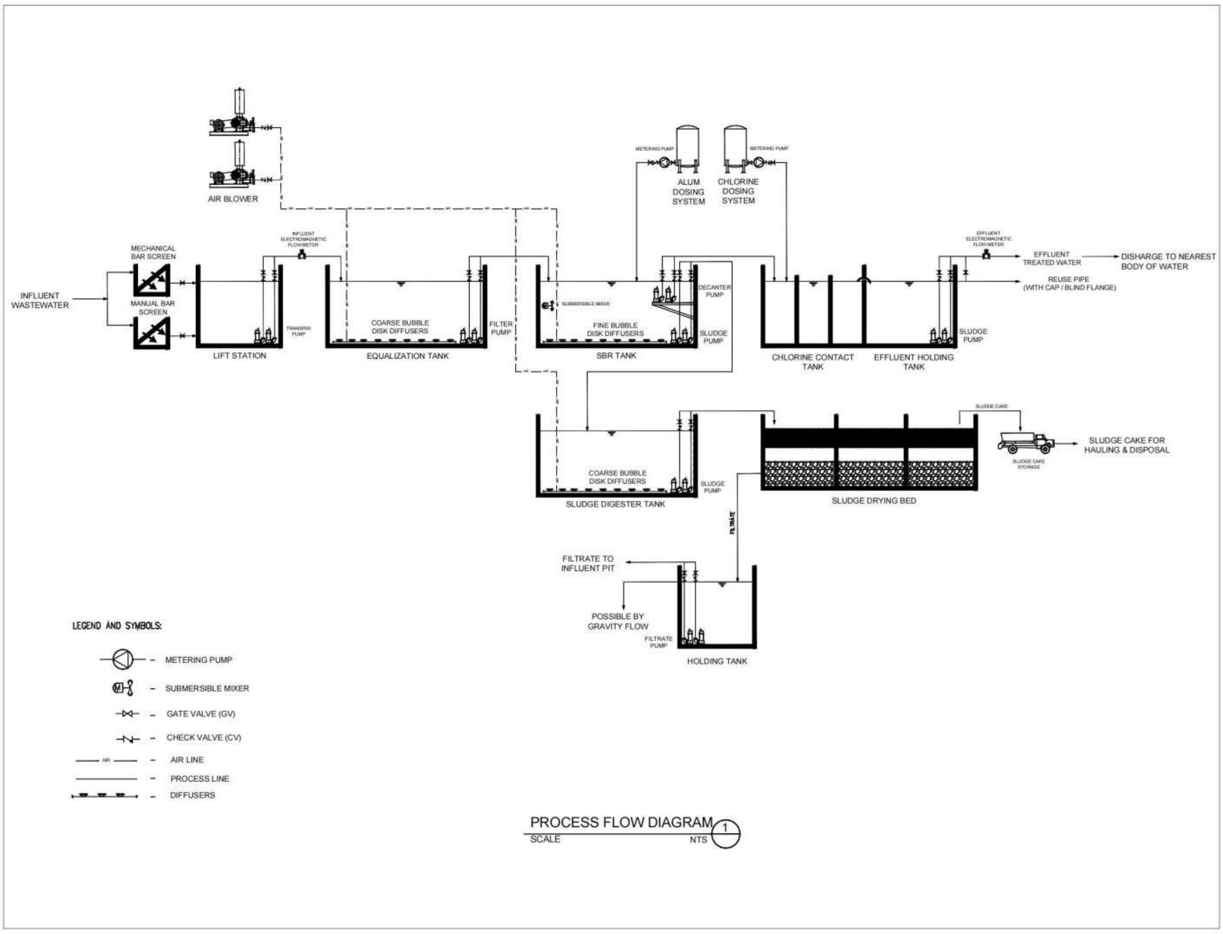
- **8 Modules** of Multi-Tier Broiler with 3 to 5 houses per module
- **Support Facilities** - The proposed project will also have workers and managers quarters, kitchen and mess hall, laundry area and covered court.
- **Power Supply** - The proposed project will be requiring around 39,318.619 kWh to be sourced from Peninsula Electric Cooperative, Inc. (PENELCO). Stand-by generator sets will also be installed for emergency power purposes.
- **Water Supply** - The proposed project will be using 2,800 m3/day which will be sourced from a surface water (Amo River) inside the project site. Water will be used for the farm operations, like cleaning and domestic purposes
- **Wastewater Treatment** – The following facilities will be provided for the treatment of wastewater that will be generated from the proposed project operations:
  - Anaerobic Baffled Reactor with Constructed Wetland - One (1) unit of ABR, one (1) unit of Engineered Constructed Wetland and one (1) unit of Chlorine Contact Tank will be provided each module.



- Wastewater Stabilization Lagoons - wastewater discharge from the seasonal cleaning of houses will be treated via series of lagoons Facultative Lagoon, Aerobic Lagoon, Maturation Lagoon and Engineered Constructed Wetland.



- Sewage Treatment Plant - domestic wastewater from the ancillary building will be treated in a STP



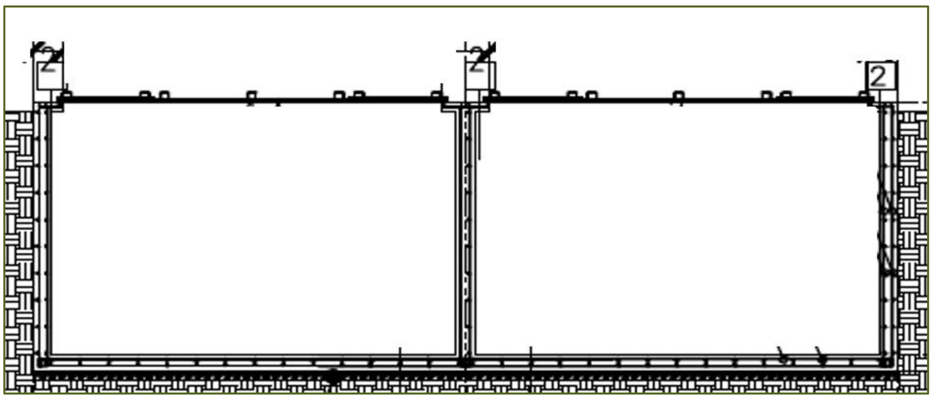
All wastewater discharges will be treated to meet the General Effluent Standards of 2016 stipulated in the DENR Administrative Order No. (DAO) 2016-08 and DAO 2021-19 before discharging into the nearby receiving body of water.

- **Solid Waste and Hazardous Management Facilities** – The following solid waste management facilities will be provided for the project:

1. ***Composting Facility*** - biodegradable wastes expected to be generated from the proposed project operations were primarily, feed waste and chicken manure. All biodegradable wastes will be sent to the Composting Facility to be constructed within the project site. All the collected chicken manure will be composted into fertilizer using the latest manure to fertilizer technology.

2. ***Material Recovery facility (MRF)*** – Non-biodegradable wastes are mostly general plastic packaging materials. Recyclable wastes to be generated from facility operations will be collected and temporarily stored in the MRF.

3. ***Mortality Pit*** – pit made up of concrete for dead chickens with at least 600mm soil cover.



4. **Hazardous Waste Storage** -hazardous wastes, such as used vaccine vials, syringes and busted bulbs, will be temporarily stored onsite in a Hazardous Waste Temporary Storage Area for off-site transport, treatment, storage, and disposal by AFAB - Accredited hazardous waste transporter and Treatment Storage and Disposal (TSD) Facility.

Fly Prevention and Mitigation Program – Layers of mitigation measures will be implemented to prevent and mitigate fly infestation during the operations of the proposed facility:

- Fly Protocol
- Fully enclosed building design (tunnel vent system);
- Mechanical interventions, such as screens and air curtains at all points of entry
  and adequate ventilation to keep manure dry;
- Use of government-approved chemical interventions; and
- Strict implementation of sanitation and biosecurity protocols

Fully Enclosed Building Design (Tunnel Vent System)

Mechanical Interventions (Use of screens and curtains)

Use of Chemical Intervention for Odor Mitigation

Use of Approved Chemicals for Fly Mitigation

Strict Implementation of Sanitation & Biosecurity

- **Other Support Facilities** – The proposed project will have other support facilities such as Guard House, Watch Tower, Truck Washer & Truck Decontamination Area, Truck Marshalling Area with Trucker's Shed and Canteen, Material Recovery Facility (MRF), Integrated Building with Composting Facility, Water Storage Tanks with Water Filtration System, Administration Building & Clinic, Open and Common Spaces, Parking Area & Buffer zones.

1.6 PROCESS/TECHNOLOGY

The Multi - Tier Broiler Farm process consists of the delivery of the day old chicks to the farm and loading into the multi layered pens. The Brooding Stage happens from Day 1 until sufficient alive weight of about 862g take place at approximately 21 days. The Growing Stage happens until the desired weight of the chicken is achieved until the Harvesting Stage to approximately Day 29 to 32-33. **Figure 1-5** shows the flow of the muti-tier operation.

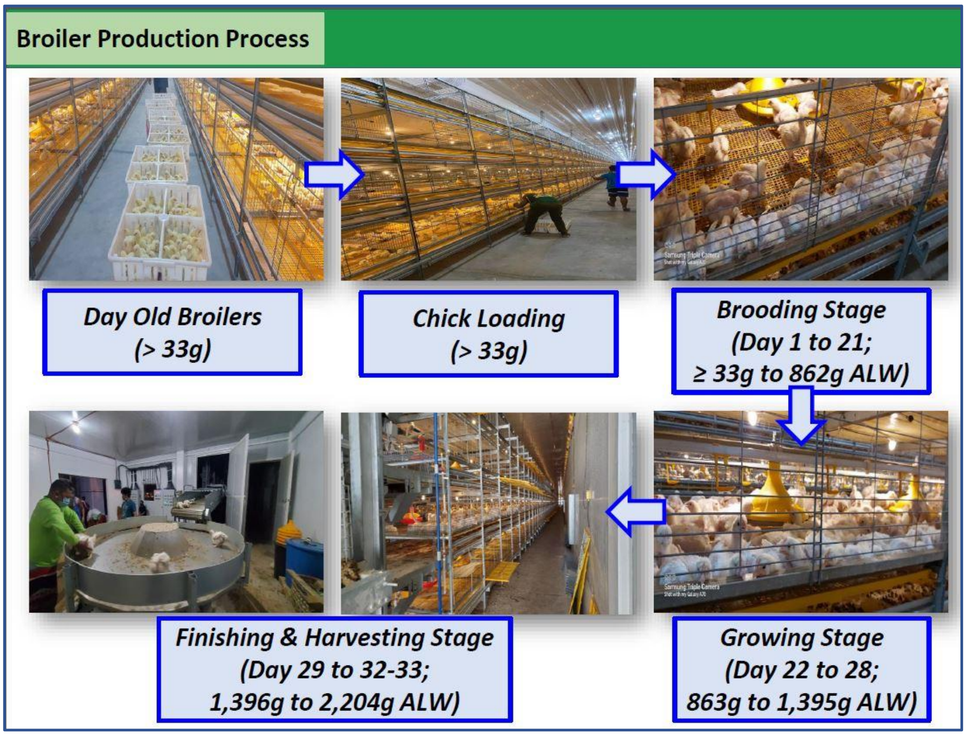


Figure 1-5 Proposed Operations Flowchart

1.7 PROJECT SIZE

The lot area of the proposed SMFI Lucanin Multi-tier Broiler Farm is 146.9 hectares.

The major components of the project and their respective capacities are presented in **Table 1-2**.

Table 1-2 List of Major Project Facilities and Capacity

PROJECT FACILITIES	NO. OF UNITS	CAPACITY (AREA/SQ.M)	AREA (SQ.M)
Broiler House (5 Houses)	20.00	34,400.00	688,000.00
Broiler House (4 Houses)	12.00	29,559.00	354,708.00
Broiler House (3 Houses)	3.00	23,048.00	69,144.00
Worker's Quarter	23.00	180.00	4,140.00

Project Facilities	No. of Units	Capacity (area/sq.m)	Area (sq.m)
Manager's Quarter	3.00	150.00	450.00
Mess hall	3.00	202.50	607.50
Covered Court	3.00	608.00	1,824.00
Security Building	1.00	180.00	180.00
Kitchen	1.00	330.00	330.00
Admin/Laboratory/Clinic	1.00	808.00	808.00
Main Decon. Building	3.00	156.30	468.90
Receiving Area	1.00	36.00	36.00
Downtime Area	1.00	180.00	180.00
Spare Parts Building & Motorpool Parking	1.00	500.25	500.25
Substation	1.00	800.00	800.00
Power Center	1.00	150.00	150.00
Truck Decon	3.00	34.20	102.60
MRF	1.00	343.00	343.00
Guard House	3.00	10.50	31.50
Watch Tower	9.00	9.00	81.00
Pump House	3.00	30.00	90.00
Truck Marshalling	1.0	18,012.00	18,012.00
Composting Facility (including storage area for raw & finished product)	1.0	4,838.00	4838.00
Roadways	1.0	88,669.42	88,669.42

PROJECT FACILITIES	NO. OF UNITS	CAPACITY (AREA/SQ.M)	AREA (SQ.M)
Open / Green Areas		234,613.27	234,613.27
TOTAL			**1,469,017.44**

1.8 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES, AND CORRESPONDING TIMEFRAMES

The SMFI Lucanin Multi-Tier Broiler Project will take about 19 months to construct. The indicative project activities and schedule are shown in **Table 1-3** and **Table 1-4**.

Table 1-3 Project Activities and Timeline

ACTIVITY/PROGRAM	TIMELINE
Start of Construction	April 2023 to December 2024
Importation of machinery and equipment	April 2023 to August 2024
Installation of machinery and equipment	September 2023 to October 2024
Hiring/Training of Personnel	October 2023 to September 2024
Start of Operations	February 2024 (Module 1 & 2) June 2024 (Module 3 & 4) October 2024 (Module 5 & 6) February 2025 (Module 7)

Table 1-4 Project Timeline

Timetable of the Project	2022				2023				2024				2025			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1. Feasibility Study and ECC																
2. Detailed Engineering Design																
3. Construction																
4. Importation of machinery and equipment																
5. Installation of machinery and equipment																
6. Hiring/Training of Personnel																
7. Start of Operations																

1.8.1 Pre-Construction

The project is in pre-construction stage. Activities for this phase include:

- Preparation of detailed engineering designs including general site development plan, building layout and details, project estimates and bill of materials;
- Environmental and Social impact assessment studies, geological and soil investigation, road access routing and tree inventory;
- Processing of necessary permits, clearances, licenses, and approvals from AFAB and various government regulators prior to construction
- Other requirements required by AFAB from concerned LGUs or offices will also be coordinated and secured.

1.8.2 Construction

This phase will cover the construction of Broiler farm and its major project components. Construction activities will include:

- Site preparation and excavation of foundation building;
- Construction of access and internal roads to the main construction fonts;

- Implementation of environmental and social mitigation measures
- Construction of major project components;
- Construction of transmission lines, water supply and sewerage facilities;
- Completion of mechanical and electrical installations

1.8.3 Operation

Typical activities during the SMFI Broiler Farm operation phase include:

- Oversee the entire operations of the proposed Project, including emergency situations
- Ensure the safety and welfare of its personnel
- Maintain conformity of the proposed Project to relevant government regulations, including tax payments, ECC compliance, etc.
- Promote and uphold harmonious relationship with the host community

1.9 MANPOWER

The SMFI Lucanin Multi-Tier Broiler Project will employ up to 400 workers during construction phase and 330 workers (198 regular ,132 contractual) upon operation. The manpower shall come mainly from qualified locals; however, the proponent and contractors will most likely be outsourcing technical personnel such as experienced professional. Medical staff will also be available onsite and may be locally sourced.

The expertise needed during construction are the Engineers, project managers. Skilled and non-skilled laborers will also be needed.

1.10 INDICATIVE PROJECT INVESTMENT COST

The indicative investment cost of Lucanin Multi-Tier Broiler Project estimated at **Php 4,803,966,948.42.**

2 KEY ENVIRONMENTAL IMPACTS AND MANAGEMENT / MONITORING PLAN

2.1 LAND

This section presents available information in terms of existing land use and classification, geology and geomorphology and pedology of the proposed project site. In order to establish baseline conditions, data and information were gathered from relevant agencies for land resources planning and monitoring, such as the National Mapping and Resource Information Authority (NAMRIA), Department of Environment and Natural Resources (DENR), and the local government unit (LGU) of Mariveles.

This also includes the baseline results and secondary data gathering of terrestrial ecology and potential impacts of the Project on land.

2.1.1 Land Use and Classification

2.1.1.1 Change / Inconsistency in Land Use

Broiler farms can have an effect on land use and land cover changes, particularly if they are established in areas that were previously used for other purposes such as crop production, forest, or grassland.

The Comprehensive Land Use Plan (CLUP) of Mariveles presents the Land Use Plan for years 2017 to 2026.

In the case of the Proposed Lucanin Multi-Tier Broiler Project, the proposed area is under agriculture classification as shown in **Figure 2-1**. These lots were declared as Industrial Zone by the Mariveles MPDO as Planned Unit Development Area of the CLUP/ Zoning Ordinance approved under (Sangguniang Panlalawigan) SP Resolution No. 2018 dated May 18, 2018 and the SB Resolution No. 089-2018 dated June 18, 2018 (as adoption). (please refer to **Annex 5 Ruzena Zoning Certificate)**

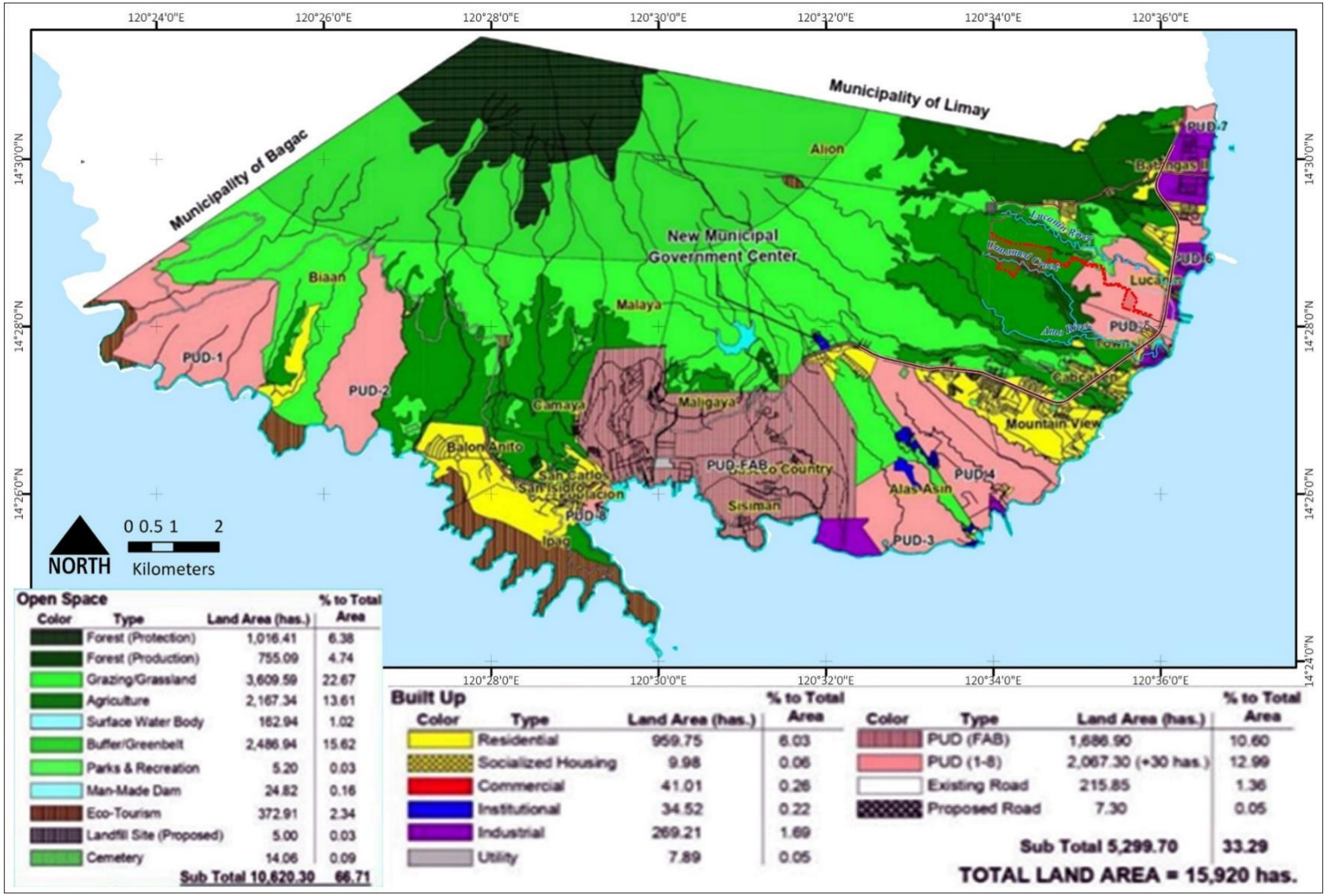


Figure 2-1 Mariveles Land Use Map

2.1.1.1.1 Encroachment in Environmentally Critical Areas (ECAs)

The project area is within and close to Environmentally Critical Areas (ECAs, as classified according to DAO 03-30's categories. Out of the twelve (12) ECAs, four (4) are located inside or adjacent to the project area. These include locations that are severely affected by natural disasters, pristine agricultural fields, sites where aquifers recharge, and regions where water bodies are accessed for residential use as well as to support wildlife and fisheries. **Table 2-1** presents the list of ECAs affected by the Project Area.

Table 2-1 ECAs Within Project Area

No.	ECA Category	Presence within Project Site
1	Protected Areas	None
2	Aesthetic Potential Tourist Spots	None
3	Wildlife Habitat	None
4	Unique Historic, Archeological, Geological Site	None
5	Ancestral Lands	None
6	Hard-hit by Natural Calamities	The Project Area is located within the following threshold of natural disasters: ☒ Not prone to liquefaction ☒ Low likelihood of tsunami ☑ Typhoon hit area ☒ Not susceptible to flood ☒ Low susceptibility to landslide ☒ No apparent and moderate erosion
7	Critical Slopes (>50% or >27°)	None
8	Prime Agricultural Lands	The proposed broiler farm will traversed agricultural land.
9	Recharge Areas of Aquifers	The project site falls within recharge areas of aquifers
10	Water Bodies for Domestic Use or Wildlife and Fishery Support	The proposed broiler farm will traverse two (2) waterways – Lucanin and Amo Rivers.
11	Mangrove Areas	None
12	Coral Reefs	None

a. Protected Areas

The Project Area does not fall within any legislated or initial component of protected areas, according to data from DENR Region III.

As shown in **Figure 2-2,** the nearest protected areas are the Palanas Watershed and Bataan National Park, which are about 9 km and 45 km away from the project site respectively.

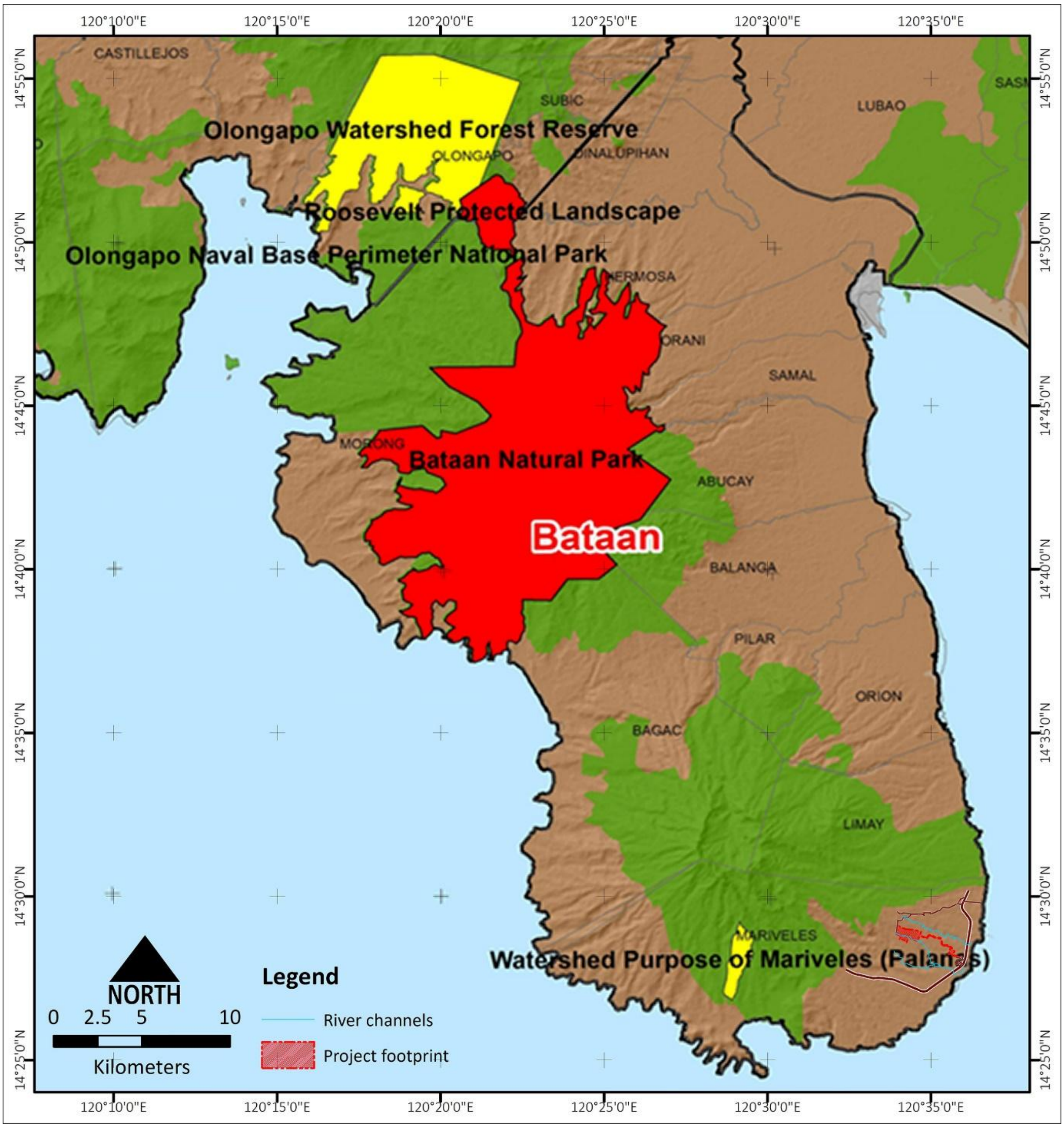


Figure 2- 2 Protected Areas Map

b. Tourist Spots

The Mariveles LGU aims to develop the tourism industry in the locality. Among the tourist spots include the Ruins of Spanish Leprosarium; Death March Kilometer 0; Balon Anito Hot Spring; Camaya Coast; Five Fingers Cove, Mt. Tarak; and Paniquian Falls.

These attractions, among others, are not expected to be affected by the proposed project. Their locations relative to the proposed broiler farm is shown in **Figure 2-3**

c. Wildlife Habitat

The nearest areas which provide the habitat for any endangered or threatened species of indigenous Philippine wildlife is the Palanas (Mariveles) Watershed. It is located in Barangays Biaan and Aton-Anito and encompasses a total area of around 2,000 hectares. The protected watershed is previously shown in **Figure 2-2**.

d. Unique Historic, Archaeological, and Geological Sites

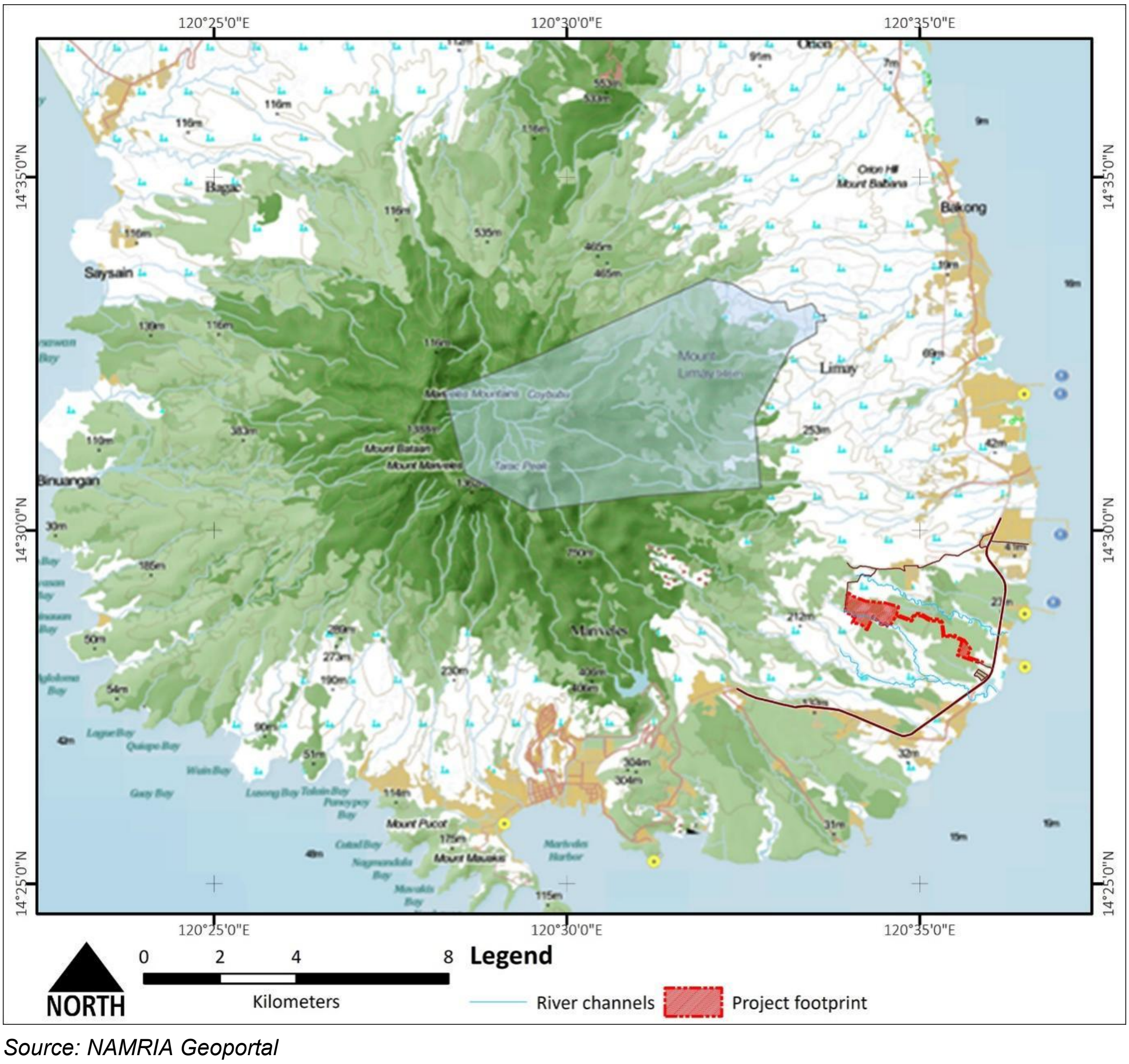
The National Historical Commission of the Philippines (NHCP) provides information on historical sites in the country. Based on information, the proposed project is at least around 200 meters from the Cabcaben Historical Marker. It is inferred that the proposed project will not have any adverse effects to these sites. The map of historical sites near the project area is shown in **Figure 2-4**

Figure 2-3 Map of Tourist Spots

Figure 2- 4 Map of Historical Sites

e. Ancestral Lands

The project area is not within any ancestral domain inhabited by Indigenous Peoples or cultural communities. The nearest identified tribe is called the Aeta Magbukon, under the CADT No. r03-LIM-1215-196 issued by the NCIP. They occupy the areas that are approximately 5 km from the project site (**Figure 2- 5)**.



Source: NAMRIA Geoportal

Figure 2- 5 Ancestral Domain (Aeta-Magbukon)

2.1.1.1.2 Hard-hit by Natural Calamities

The whole Bataan province is vulnerable to a range of natural disasters due to its geographical location and physical characteristics. Some of the natural disasters that Bataan is vulnerable to include typhoons, floods, landslides, earthquakes, and volcanic eruptions. Here are some of the factors that contribute to Bataan's vulnerability to these disasters:

Overall, Bataan province's vulnerability to natural disasters highlights the importance of disaster preparedness and risk reduction measures to minimize the impacts of these events on the local population and infrastructure.

a. Landslide

Bataan is characterized by rugged mountain ranges that run from north to south, which can cause landslides and rockfalls during heavy rains and earthquakes. The following figures show the landslide susceptibility of Mariveles, as sourced from the CLUP. The proposed project falls within areas of none to very low susceptibility.

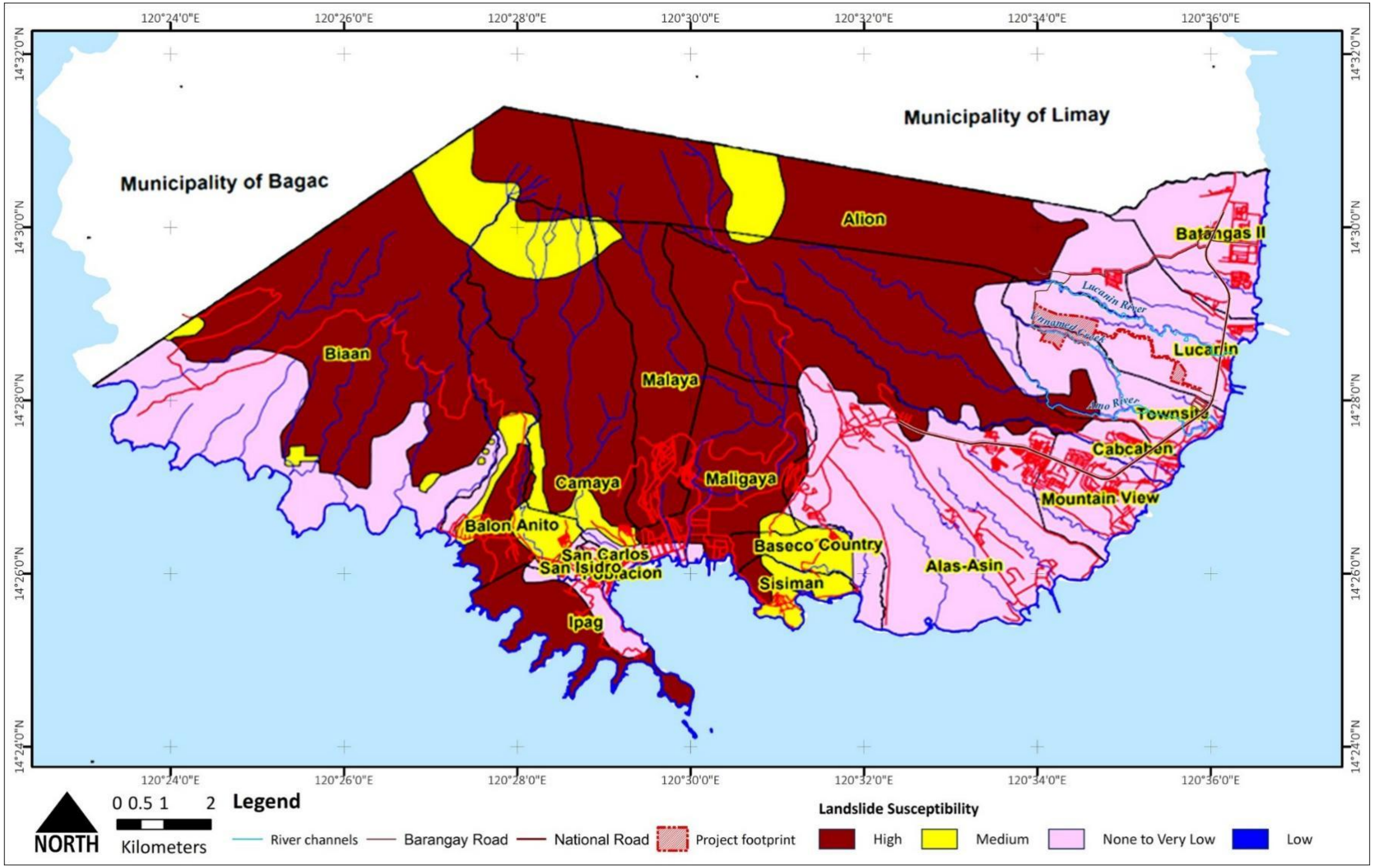


Figure 2- 6 Landslide Susceptibility Map

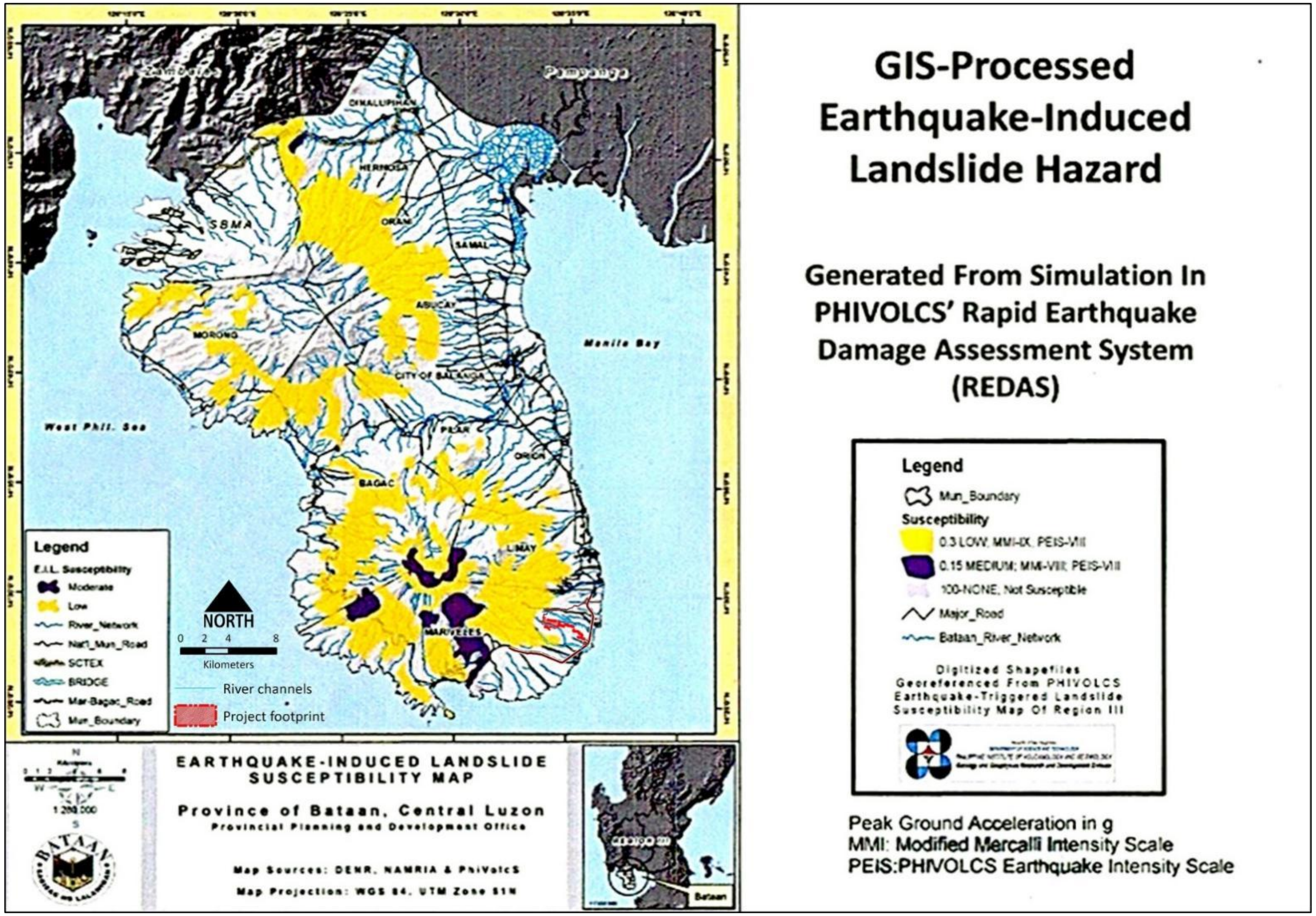


Figure 2- 7 Earthquake-Induced Landslide Hazard Map

b. Tsunami

Mariveles is situated along the coast of Manila Bay, which makes it potentially susceptible to tsunamis. However, the likelihood of a tsunami occurring in this area is considered to be relatively low.

The project site is situated along the eastern coast of Manila Bay, which is not directly exposed to the open ocean. As a result, the likelihood of a major tsunami generated by an earthquake in the Pacific Ocean affecting the project site is relatively low. There are also no recorded historical events of tsunamis affecting Mariveles, which indicates that the likelihood of a tsunami occurring in the area is relatively low.

However, it is still important for local authorities and residents to be prepared and aware of the potential risks, and to take appropriate measures to minimize the impact of tsunamis in the event that they do occur.

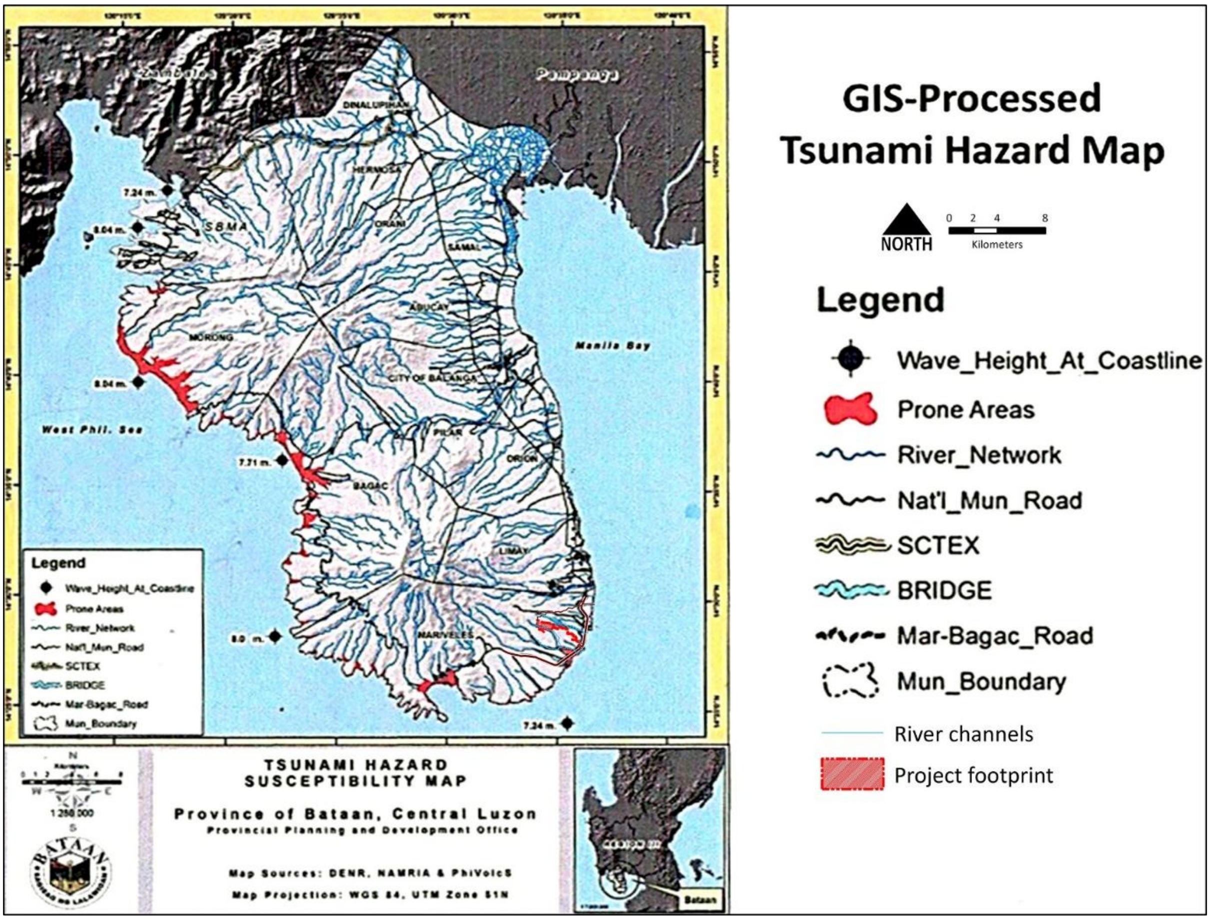


Figure 2- 8 Tsunami Hazard Map

c. Typhoon and Flooding

Lucanin, Mariveles, Bataan is a coastal town located in the western part of the Bataan Peninsula in the Philippines. The area is susceptible to flooding due to its location in a low-lying coastal plain and the presence of several rivers and streams that drain into the sea.

During heavy rainfall events or typhoons, the rivers and streams in the area can overflow their banks, causing flooding in nearby low-lying areas. In addition, the proximity of Lucanin to the coastline makes it vulnerable to storm surges, which are sudden rises in sea level caused by strong winds and low atmospheric pressure associated with tropical cyclones.

The susceptibility of Lucanin, Mariveles, Bataan to flooding is also influenced by human activities such as deforestation and land-use changes. The removal of vegetation cover in the upstream areas of rivers and streams can increase the runoff and sedimentation rates, leading to more frequent and severe floods downstream. Land-use changes, such as the conversion of natural wetlands to agricultural or urban areas, can also affect the natural drainage patterns, leading to flooding in areas that were not previously prone to flooding.

Figure 2-9 below shoes the inundation that may be caused by a 100-yr return period flood, as simulated by Project NOAH. (*8/25/21 refers to the Google Imagery date, the date that the google satellite image was taken).* It can be seen that minimal flooding along the waters can be expected and easily mitigated through site grading and other minimal construction interventions.

The flood inundation data was based on flood simulations as well as satellite and historical data from Project NOAH (Nationwide Operational Assessment of Hazards) released in 2023. NOAH is a project of the Department of Science and Technology's (DOST) in order to produce more accurate, integrated, and responsive disaster prevention and mitigation system, especially in high-risk areas throughout the Philippines. The Project incorporates data and findings from PAGASA, PHIVOLCS, and the DOST-Advanced Science and Technology Institute (ASTI), in partnership with the UP National Institute of Geological Sciences and the UP College of Engineering.

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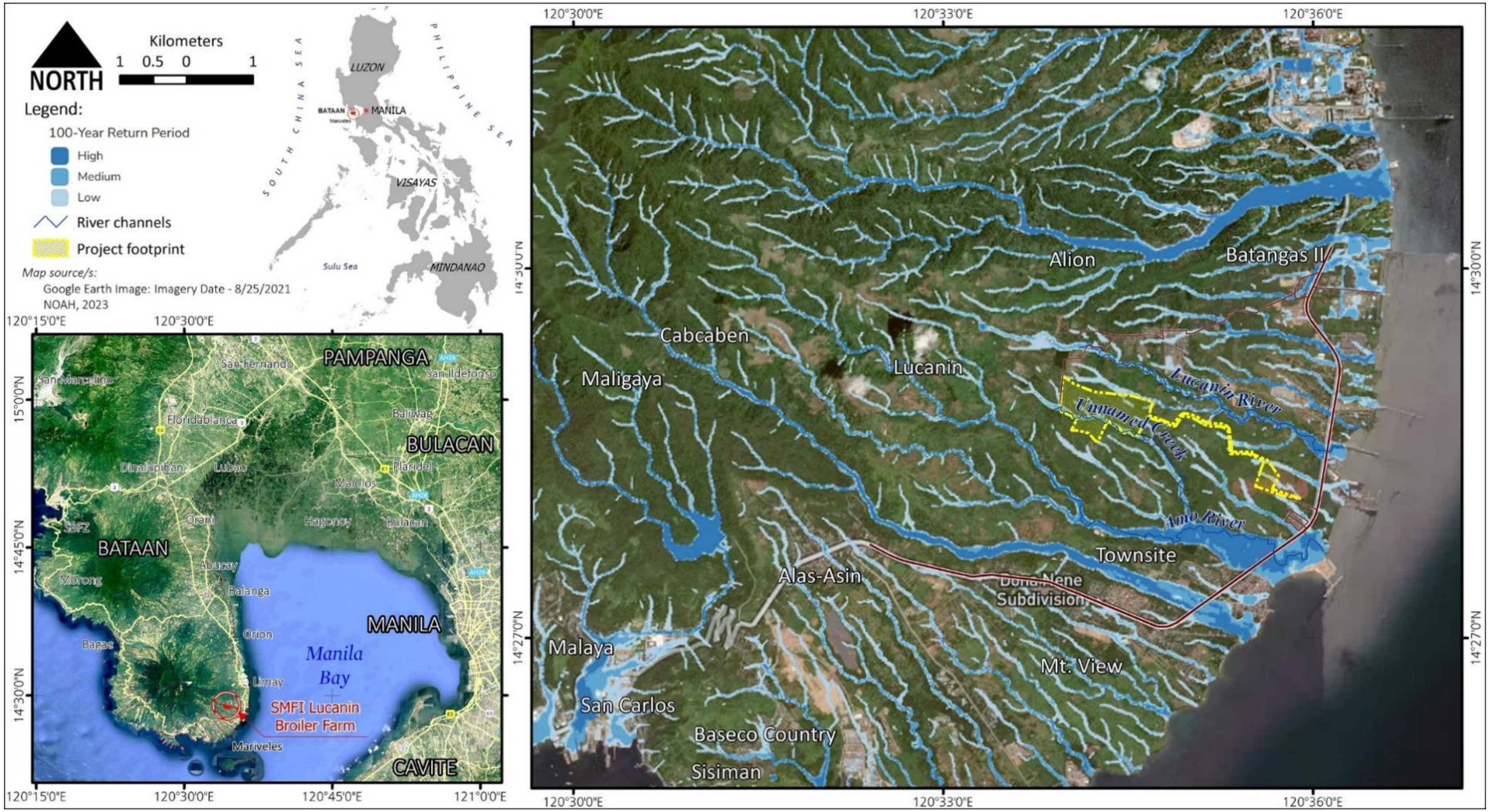

Figure 2-9 100-yr Flood Inundation Map (NOAH, 2023)

d. Seismic

Bataan is located in a seismically active area, which means that it is vulnerable to earthquakes. The province is also situated near several active volcanoes, including Mount Pinatubo, which erupted in 1991 and caused widespread damage and loss of life.

2.1.1.1.3 Critical Slope

The Municipality of Mariveles is predominantly hilly and mountainous which accounts for one half of its area. Its communities were built along the slope of the imposing Mt. Mariveles. Flat lands constitute 26.28% of the total municipal area and are confined to the eastern portion of the municipality. Pockets of flat land areas are also found in the western portion of Mariveles.

The slope classification of the Municipality of Mariveles reflects that about 47.35% of its land are with 0-10% slope, level to gently sloping, suitable for agricultural and urban development. About 53.65% are rolling and mountainous.

As shown in **Figure 2-10,** the proposed Lucanin Multi-Tier Broiler Project falls under level to undulating, with slope values from 0 to 8%.

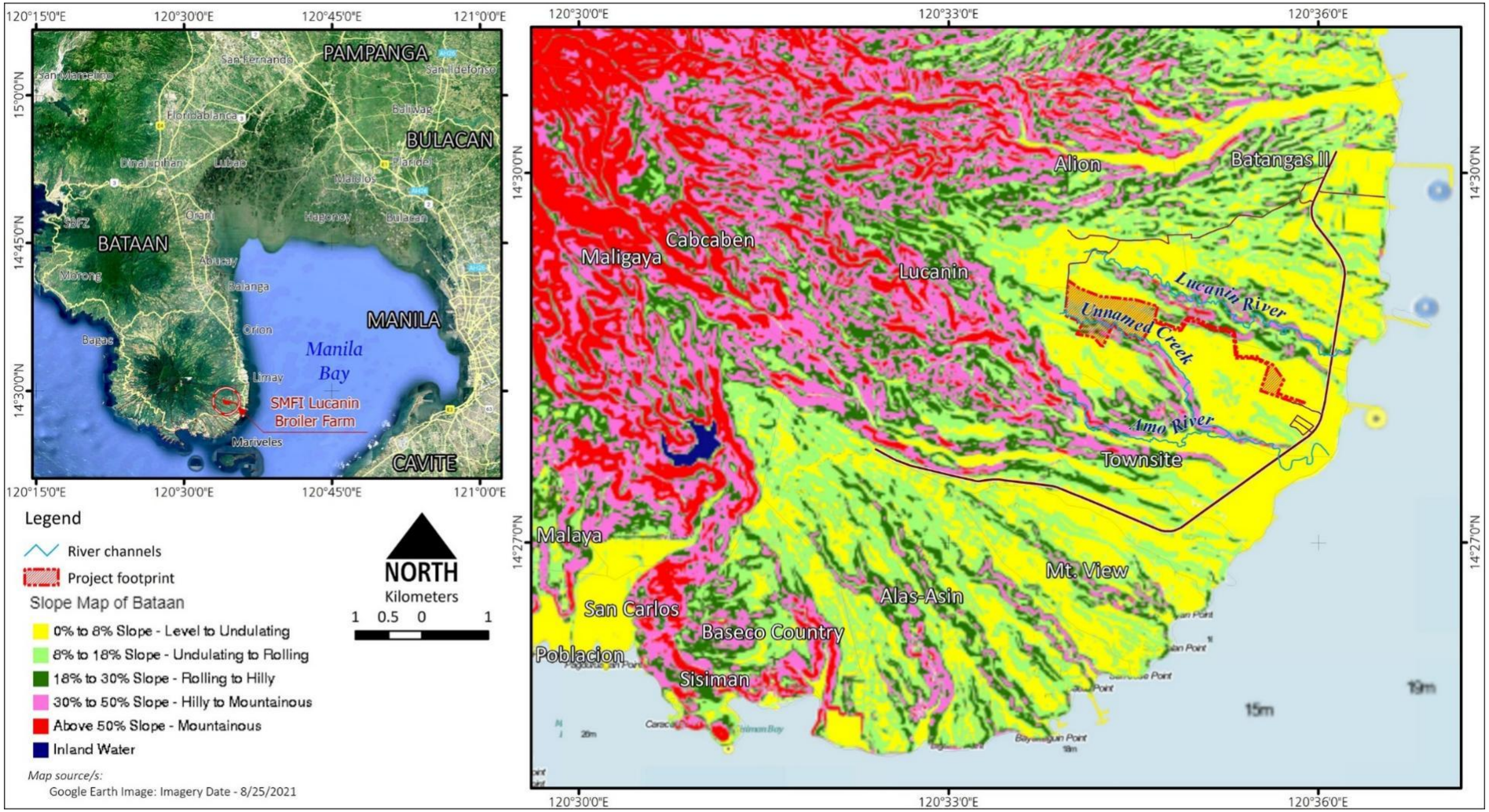

Figure 2- 10 Slope Map (NAMRIA)

2.1.1.1.4 Prime Agricultural Lands

Based on the existing land use plan of the Municipality of Mariveles, around 14% of the land is used for agricultural purposes. These areas mainly cultivate corn, cassava, plantation crops, and other upland crops.

As previously shown, the proposed Lucanin Muli-Tier Broiler Farm falls under agricultural lands. However, based on the Zoning Certification issued by Mariveles LGU, the project area classification was already updated to industrial use.

2.1.1.1.5 Recharge Areas of Aquifers

Data from DENR-MGB indicate that the project area traverses the local and less productive aquifers, with minimal effects on groundwater contamination through infiltration, which can be easily mitigated by proper management of wastewater.

2.1.1.1.6 Water Bodies

The proposed broiler farm traverses the Lucanin and Amo Rivers. Both flow in a east-southeast direction and empties into the Manila Bay.

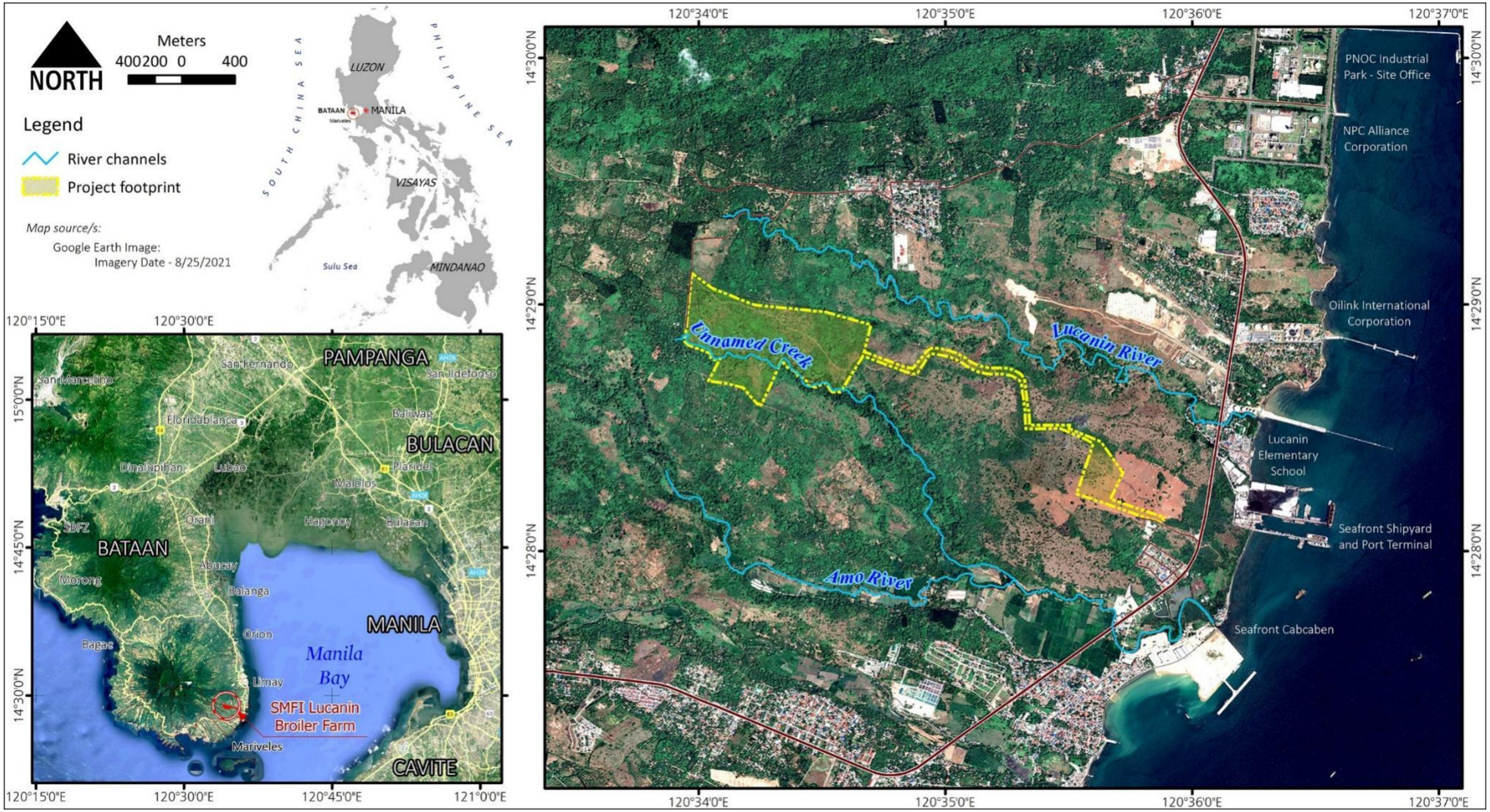

Figure 2- 11 Water Bodies Map

2.1.1.1.7 Mangrove Areas

Based on data and information from Geoportal (NAMRIA, 2016), there are no nearby mangrove areas in the immediate vicinity of the project area that will be affected.

2.1.1.1.8 Coral Reefs

The proposed Lucanin Multi-Tier Broiler Project is found within inland areas, and thus will not affect any coral reefs within its vicinity.

2.1.1.1.9 Possible Tenurial / Land Issue

The project site is titled and owned by REDC. The location does not fall into areas covered by the Comprehensive Agrarian Reform Program (CARP), Mineral Production Sharing Agreement (MPSA), or any other tenurial instruments in place. **Figure 2-13** shows the Tenurial Instruments Map,

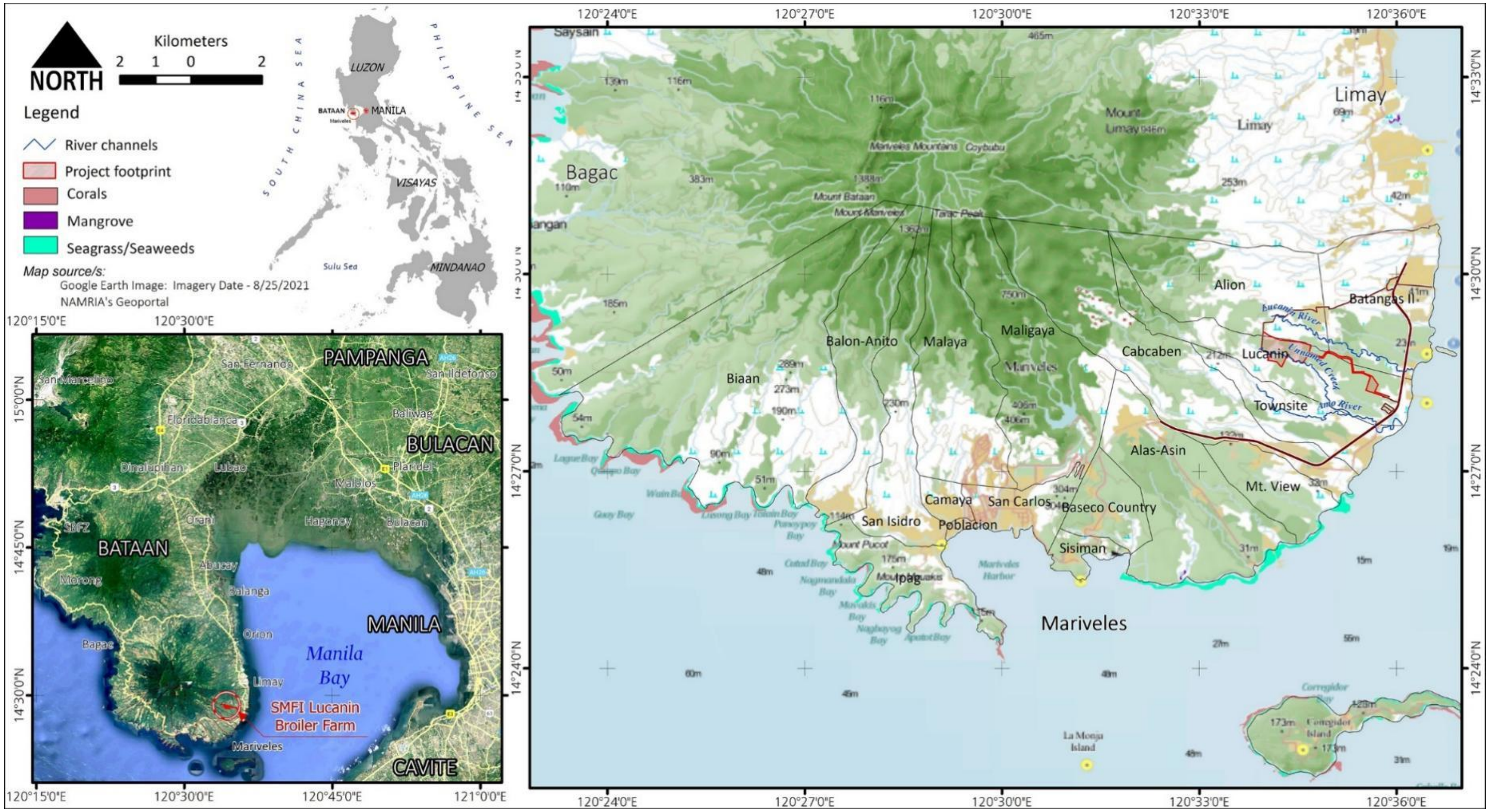

Figure 2- 12 Coastal Resource Map

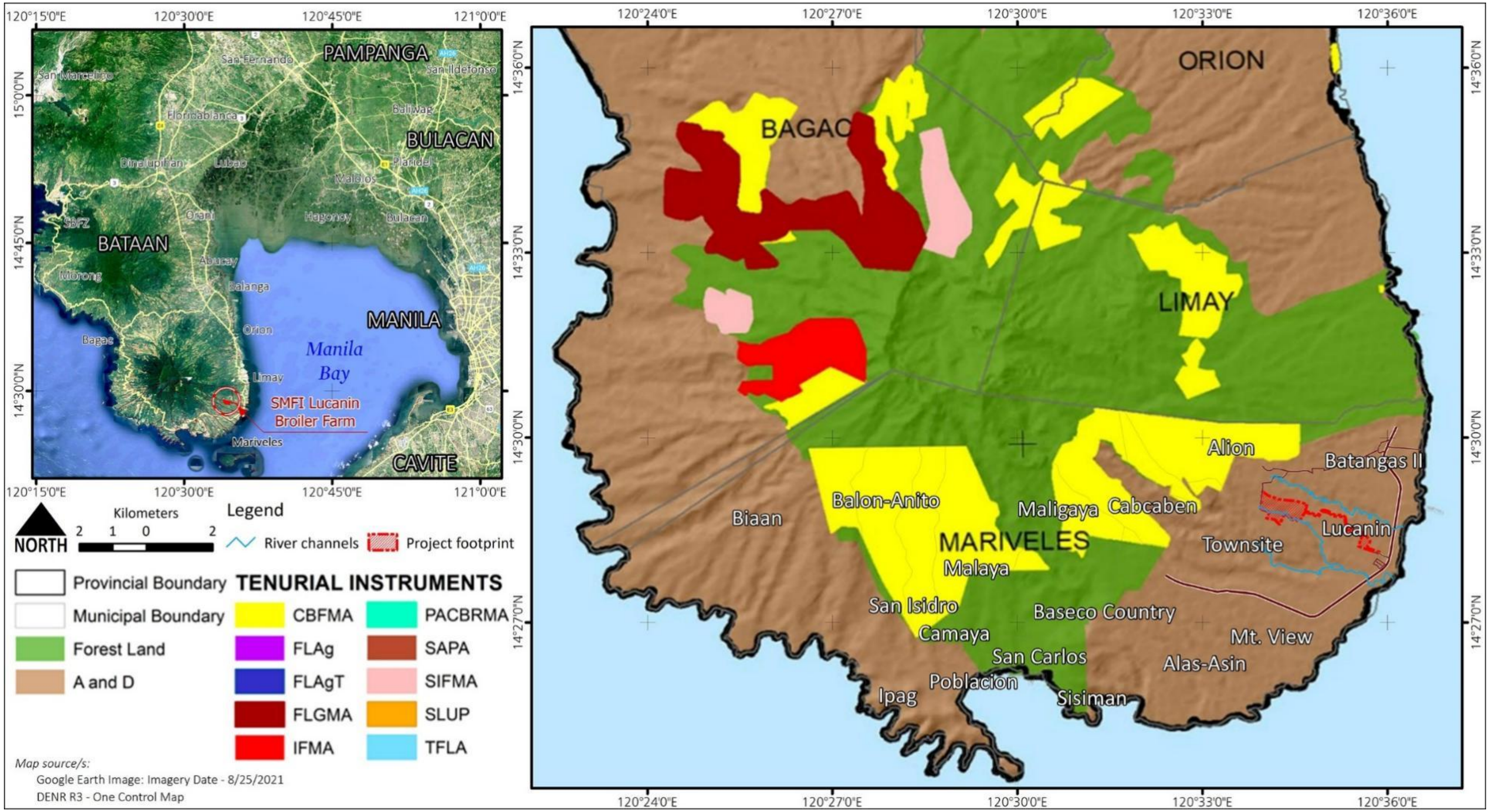

Figure 2-13 Tenurial Instruments Map

2.1.2 Geology and Geomorphology

This sub-section provides the discussion of the geology and the project site and aims to present information on rock properties at the subsurface and within the vicinity of Mariveles where the proposed Lucanin Multi-Tier Broiler Project will be located.

2.1.2.1 Change in Surface Landforms / Topography / Terrain / Slope

Lucanin is characterized by rugged and hilly terrain, with elevation ranging from sea level up to about 190 meters above sea level around the proposed broiler farm. The project area is located on the slopes of the Mount Mariveles, which is a dormant volcano that forms a prominent part of the landscape in the region.

The terrain of Lucanin is dominated by steep slopes and deep valleys, with the highest peaks found in the northern part of the area. The topography is marked by numerous small streams and rivers, including the Lucanin River, which runs through the area and eventually empties into Manila Bay. The river system is an important source of water for irrigation and domestic use in the area.

The rugged topography of Lucanin and the surrounding region has limited the amount of flat, arable land available for agricultural use. Instead, agriculture in the area is largely limited to small-scale, subsistence farming on the steep slopes, with crops such as rice, corn, and vegetables grown on terraced fields. The hilly terrain of Lucanin also makes it a popular destination for hiking and outdoor activities, with several trails and campsites located in the area. **Figure 2-14** shows the topography of the area.

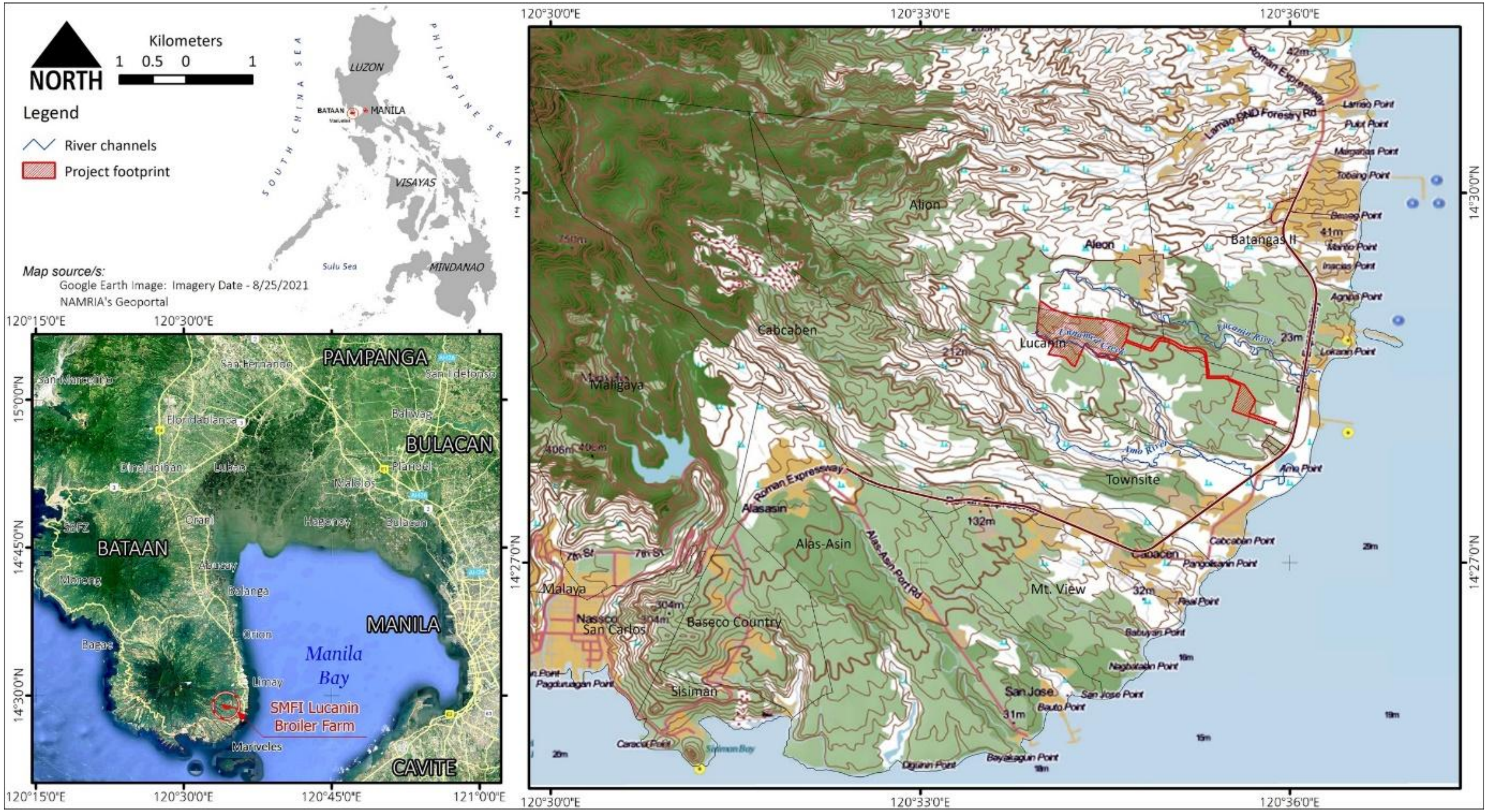

Figure 2-14 Topographic Map

The establishment of a broiler farm can have a range of impacts on the surface landforms, topography, terrain, and slope of the surrounding area. This includes soil erosion and compaction during construction. The extent and severity of these impacts will depend on a range of factors, including the size of the farm, the nature of the surrounding landscape, and the management practices employed by the operators of the farm. Proper planning, design, and management can help to minimize these impacts and ensure that the farm operates in a sustainable and environmentally responsible manner.

2.1.2.2 Change in Sub-Surface / Underground Geomorphology

Broiler farms may have potential effects on sub-surface underground geomorphology, particularly if they are established in areas where the soil structure and underlying geology are fragile or sensitive to changes.

The area around Mariveles is underlain by a series of sedimentary rocks, including sandstones, shales, and conglomerates, which were deposited in shallow marine environments during the late Cretaceous period. These rocks have been uplifted and folded by tectonic forces, forming a series of ridges and valleys that characterize the topography of the region.

The western part of Mariveles is dominated by a large granitic intrusion, which is part of a larger batholith that extends throughout much of western Luzon. The granite is typically coarse-grained and contains a variety of mineral assemblages, including feldspar, quartz, and mica. The intrusion is thought to have formed during the late Oligocene to early Miocene, around 25-30 million years ago, as a result of subduction-related magmatism.

In addition to the sedimentary rocks and granites, Mariveles is also underlain by a variety of volcanic rocks, including basalt, andesite, and dacite. These rocks are associated with the volcanic arc that formed along the western margin of the Philippine Sea Plate during the Miocene to Pliocene epochs.

The proposed project will only consist of minor excavation activities, and thus, is not expected to cause changes in the sub-surface / underground geomorphology of the area.

2.1.3 Pedology

2.1.3.1 Soils of the Project Area

The predominant soil type in the Municipality of Mariveles is Antipolo Clay and Pilar. Antipolo clay is a type of soil that is predominantly composed of clay, which is a fine-grained mineral material that is formed from the weathering of rocks. It is typically reddish-brown in color and has a smooth, sticky texture. Antipolo clay soil is characterized by its high water-holding capacity, which can lead to poor drainage and waterlogging in areas with heavy rainfall. This can make the soil less suitable for some types of crops, particularly those that require well-drained soils. However, Antipolo clay soil can also be rich in nutrients and organic matter, making it suitable for agriculture in certain conditions. Farmers may need to amend the soil with organic matter, such as compost or manure, to improve its fertility and structure.

Pilar silt loam is classified as a mineral soil, meaning it is composed primarily of mineral particles such as sand, silt, and clay. It is characterized by a medium to fine texture, with a high percentage of silt and a moderate amount of clay. it may be prone to erosion if improperly managed or if exposed to heavy rainfall. Soil health management practices, such as cover cropping, crop rotation, and conservation tillage, can help to maintain soil structure and reduce erosion risks.

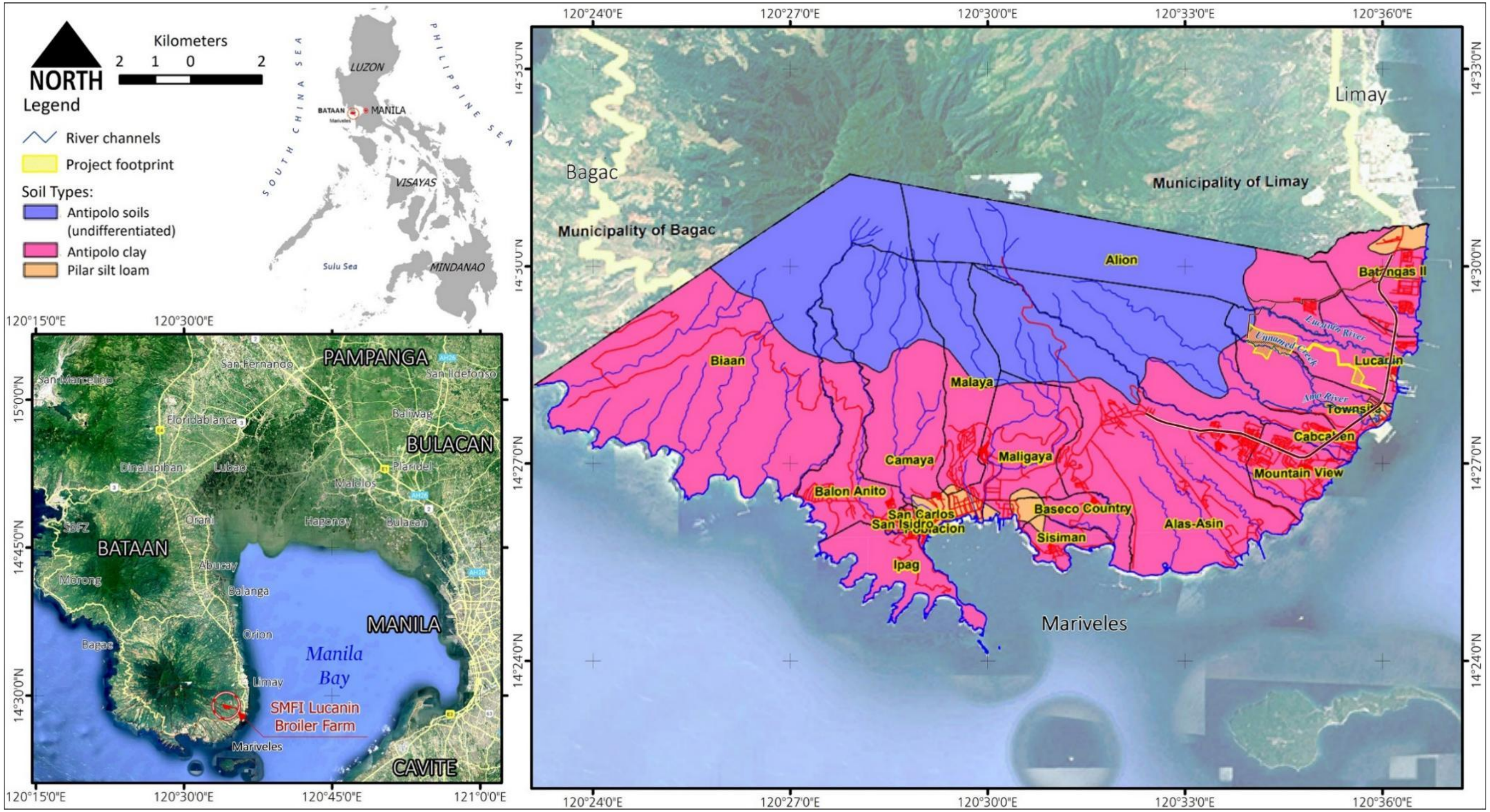

Figure 2-15 Soil Map

2.1.3.2 Soil Sampling

Two (2) soil samples were obtained from the project area. Soil test pits are typically manually dug and soil samples are placed in sampling bags sand labelled accordingly. These samples are sent for laboratory testing of physical and chemical parameters.

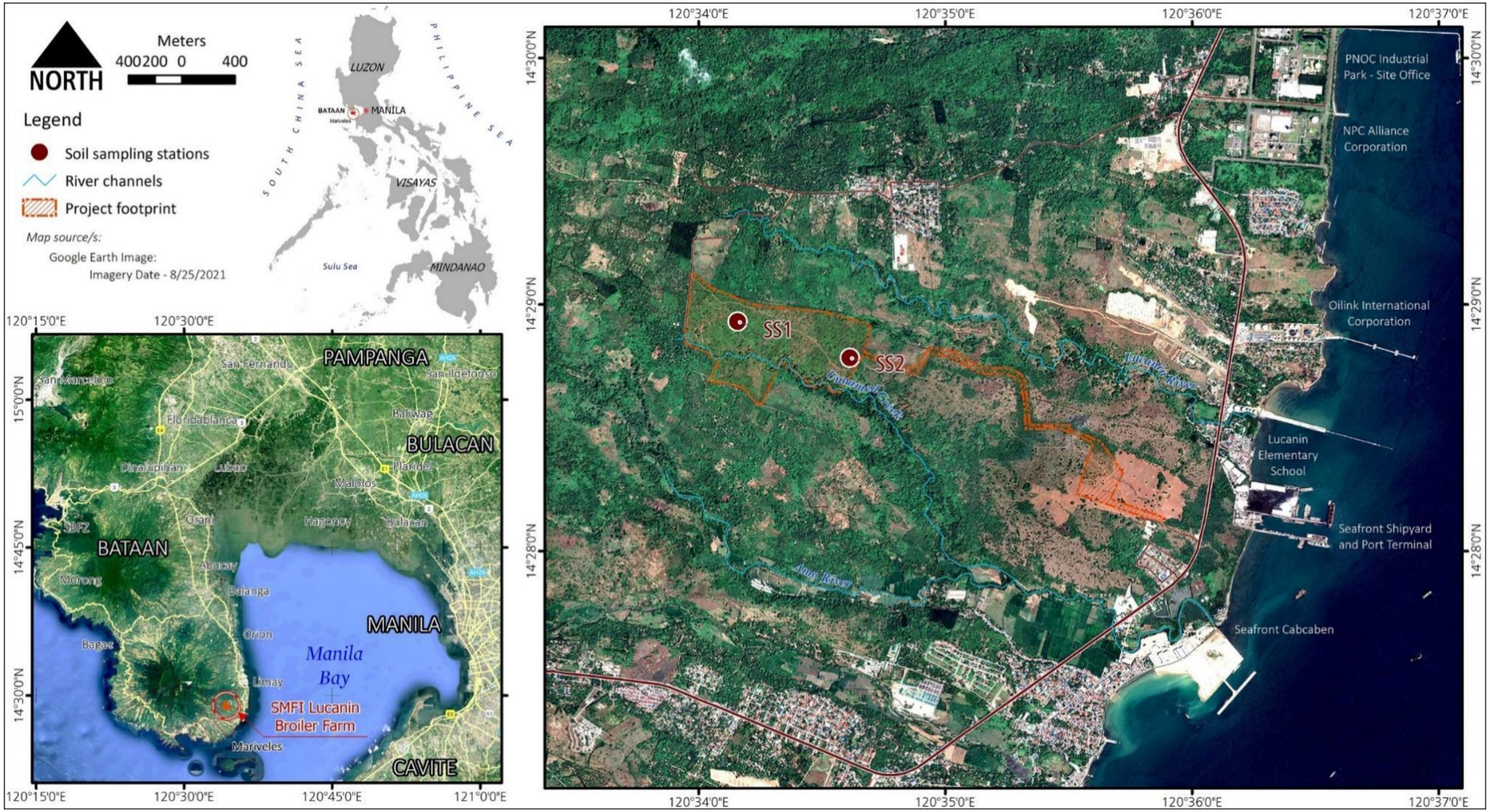

Figure 2- 16 Soil Sampling Stations

Table 2- 2 Soil Sampling Activities

SAMPLE ID	PHOTOS	DESCRIPTION OF SAMPLING STATION	COORDINATES
S1		Sampling Date: Feb 09, 2023 Sampling Time: 0900H Weather during sampling: Sunny Brief description of the sampling station: Vegetative area with clayey silt soil type (light brown colored)	14°28'55.83"N 120°34'9.50"E
S2		Sampling Date: Feb 09, 2023 Sampling Time: 0800H Weather during sampling: Sunny Brief description of the sampling station: Vegetative area with clayey silt soil type (reddish brown colored)	14°28'47.04"N 120°34'36.80"E

The results of the soil analysis are shown below. Soil fertility parameters were evaluated against the Bureau of Soils and Water Management (BSWM) Guide to Fertilizer Recommendation for Rice and Corn, 2014. In addition, the ASEAN Soil Nutrient Guidelines was also referenced.

Table 2-3 Soil Analysis Result

Parameters	Stations		Soil Fertility Rating Guidelines (BSWM, 2014)			ASEAN Nutrient Guidelines	
	SS1	SS2	Moderate (Moderately Unfavorable)	Adequate (Favorable)	Deficient (Unfavorable)	Low	High
Nitrogen (%)	0.0744	0.0799	-	-	-	<0.1	0.1 – 0.4
Phosphorus (%)	0.0437	0.0420	6 – 10	>10	<6		
Potassium (%)	0.0077	0.0049	50 - 75	>75	<50		

As the results show, all parameters in both sampling stations fall below the favourable standards set forth by the guidelines.

Low nitrogen levels in soil can have several implications for plant growth and crop yields. Nitrogen is an essential macronutrient required by plants for various biological processes such as photosynthesis, protein synthesis, and DNA synthesis. When there is insufficient nitrogen in the soil, plants may exhibit stunted growth, yellowing leaves, reduced yield, susceptibility to diseases, and lower quality produce.

Low levels of potassium and phosphorus in soil can also have significant implications for plant growth and crop yields, as both nutrients are essential for various biological processes in plants. Some of the implications of low potassium and low phosphorus in soil include poor root development, decreased photosynthesis, susceptibility to diseases, and reduced yield.

2.1.3.3 Soil Erosion / Loss of Topsoil / Overburden

The removal of vegetation to make way for broiler farm facilities can expose the soil to erosion from wind and water. This can lead to the loss of valuable topsoil, which contains organic matter and nutrients that are essential for plant growth.

The regular movement of heavy equipment and vehicles used in broiler farming can cause soil compaction, which reduces the infiltration of water and air into the soil and makes it more difficult for plants to grow.

2.1.3.4 Change in Soil Quality / Fertility

Like any intensive animal agriculture operations, broiler farms have the potential to negatively impact soil quality and fertility if proper management practices are not implemented.

Since the proposed Lucanin Multi-Tier Broiler Project proposed the use of a digester, it can potentially produce a nutrient-rich fertilizer that can be used to improve soil quality and fertility. The fertilizer produced by the digester contains high levels of nitrogen, phosphorus, and other micronutrients that are essential for plant growth. The digester can help to reduce the amount of organic waste generated by the farm, and the fertilizer produced by the system can be used to improve soil health and crop yields.

Furthermore, by using the fertilizer produced by the digester, the farm can potentially reduce its reliance on synthetic fertilizers, which can be expensive and contribute to environmental problems such as eutrophication and soil acidification.

On the negative side, the use of the digester can potentially contribute to soil degradation if the system is not properly designed, operated, or maintained. For example, if the digester generates wastewater with high levels of nutrients or other contaminants, and this wastewater is not properly disposed of or treated, it may negatively impact soil quality and fertility. Additionally, if the farm is applying the fertilizer produced by the digester at levels that exceed the crop's needs, this can lead to nutrient runoff, which can contribute to eutrophication and other negative impacts on soil and water quality.

Overall, the use of the proposed digester technology’s impact on soil quality and fertility is influenced by a number of variables, including the system's design, operation, and maintenance, as well as the surrounding environment and soil properties. The farm must make sure that the system is run in a way that maximizes the beneficial effects on soil fertility and quality while limiting any adverse effects.

2.1.4 Terrestrial Ecology

This sub-section describes the existing flora and fauna of the proposed Project. The terrestrial ecology assessment includes both vegetation (i.e. vascular plants including trees, shrubs, vines, grasses, herbs and epiphytes) and wildlife (i.e. amphibians, reptiles, birds, and mammals).

*The field surveys were conducted from January 13 -15 2023. The identification of sites to be assessed in the barangays Alion, Townsite and Lucanin were determined by purposive sampling. The stations were selected within vegetated areas, patches and strips as determined using available satellite images. A total of nine (9) plots were established for the whole study area (**Table 2-4**), particularly in areas that had not been studied prior to this assessment.*

2.1.4.1 Terrestrial Flora

2.1.4.1.1 Methodology

Belt transect method was used on each site to be assessed. Transect lines were established perpendicular to a baseline. A nested 10x10m quadrat was established at every 250-m interval of the transect lines to account for trees (DBH >5cm). Parameters measured were diameter at breast height (DBH) and height. A 3x3m subplot was established to account for poles and saplings (DBH <5cm) and another 1x1m to account for regenerants (DBH <2cm) and ground cover (floral species <1 m).

Assessment of the stand structure and density was also conducted to estimate the extent of the land surface covered by the vegetation. Some of the data gathering activities during the flora survey are shown in

Plate 2- 1 and the location of the sampling plots that were assessed in this study are shown in **Figure 2- 17**.

Table 2-4 Description, Location and Coordinates of the Plots Assessed

TRANSECT	PLOT	LOCATION	COORDINATES	COVER DENSITY (ESTIMATE)	DOMINANT TREE SPECIES
1	1	Brgy. Lucanin, Mariveles, Bataan	N 14°22'52.30", E 121°19'56.21"	Sparse	*Gliricidia sepium, Antidesma ghaesembilla* and *Chromolaena odorata*
	2	Brgy. Lucanin, Mariveles, Bataan	N 14°22'45.60", E 121°19'53.34"	Adequate	*Gliricidia sepium*, *Lagerstroemia speciosa* and *Paspalum conjugatum*
	3	Brgy. Alion, Mariveles, Bataan	N 14°22'35.09", E 121°19'47.20"	Adequate	*Gliricidia sepium, Antidesma ghaesembilla,* and *Paspalum conjugatum*
2	1	Brgy. Alion, Mariveles, Bataan	N 14°22'31.05", E 121°19'41.64"	Sparse	*Antidesma ghaesembilla, Lagerstroemia speciosa* and *Wrightia pubescens*
	2	Brgy. Alion, Mariveles, Bataan	N 14°21'49.94", E 121°19'28.85"	Sparse	*Pterocymbium tinctorium, Macaranga tanarius and Tabernaemontana pandacaqui*
	3	Brgy. Townsite, Mariveles, Bataan	N 14°21'38.59", E 121°19'21.85"	Sparse	*Gliricidia sepium, Antidesma ghaesembilla* and *Tabernaemontana pandacaqui*
3	1	Brgy. Alion, Mariveles, Bataan	N 14°21'30.48", E 121°19'13.10"	Sparse	*Antidesma ghaesembilla* and *Chromolaena odorata*
	2	Brgy. Alion, Mariveles, Bataan	N 14°29'1.78", E 120°34'9.42"	Sparse	*Syzygium cumini*, *Swietenia macrophylla* and *Isachne albens*
	3	Brgy. Alion, Mariveles, Bataan	N 14°29'3.50", E 120°34'6.59"	Sparse	*Wrightia pubescens*, *Gliricidia sepium* and *Paspalum conjugatum*

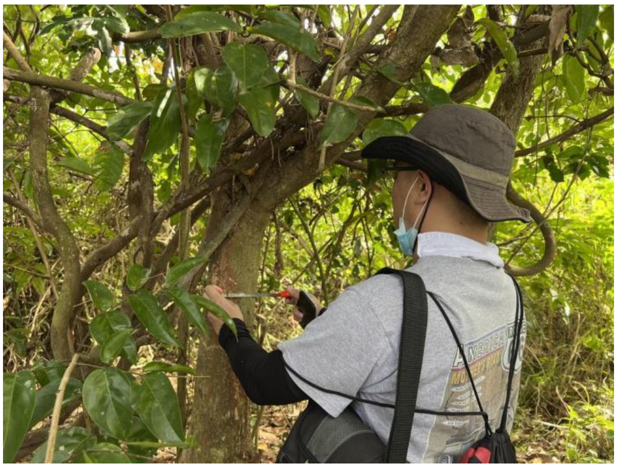

Plate 2-1 Measurement of Diameter at breast height (DBH) (left) and geotagging of sampling plot (right)

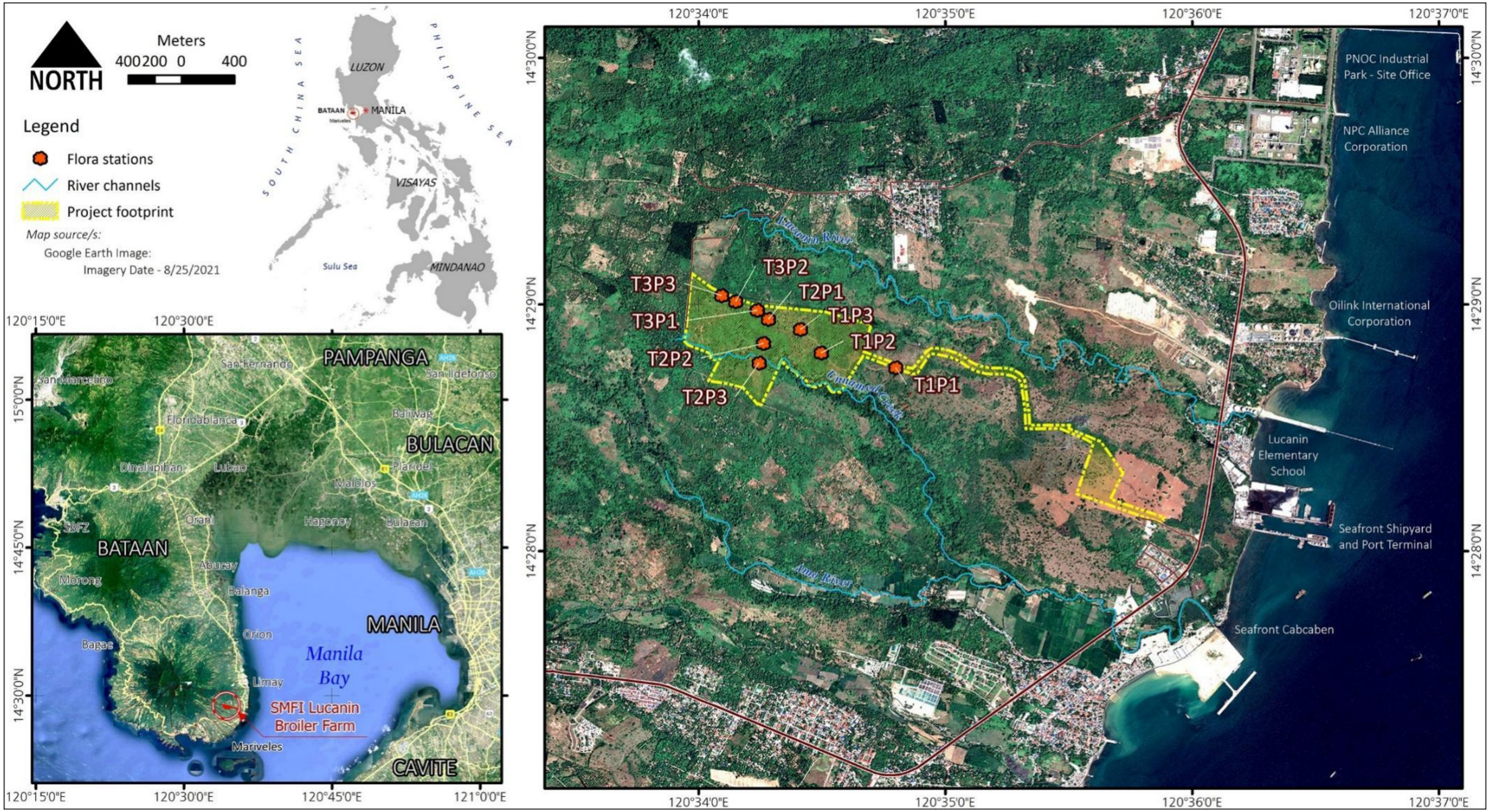

Figure 2-17 Map of the Assessed Sampling Plots

Computation of the Importance Values (IVs)

Importance Values (IVs) of each species on an assessed ecosystem give us information of each species' role on the dynamics of the habitat. This value is the summation of the Relative Density (RDen), Relative Frequency (RFreq) and Relative Dominance (RDom) of the species intercepted on the plots. Formulae to be used in the computation of IV are as follows:

$$Density = \frac{Number\ of\ individuals\ per\ species\ in\ a\ specific\ quadrat}{Total\ area\ assessed}$$

$$Relative\ Density\ (RDen) = \frac{Density}{Total\ density\ of\ all\ species}\ x\ 100$$

$$Frequency = \frac{Number\ of\ quadrats\ in\ which\ a\ species\ occured}{Number\ of\ quadrats\ studied}$$

$$Relative\ Frequency\ (RFreq) = \frac{Calculated\ absolute\ frequency\ of\ a\ species}{Total\ frequencies\ of\ all\ the\ species}\ x\ 100$$

$$Dominance = \frac{Basal\ area\ of\ a\ species}{Total\ area\ sampled}$$

$$Relative\ Dominance\ (RDom) = \frac{Dominance\ of\ a\ species}{Dominance\ of\ all\ species}\ x\ 100$$

$$Importance\ Value\ (IV) = Rden + RFreq + RDom$$

Computations for the Diversity Indices

Diversity indices of the plots assessed were computed. These indices describe if the biodiversity of the assessed areas is high or low. Indices computed include Shannon-Wiener Index, Pielou's Evenness Index, Simpson's Index, and Margalef Richness Index. These values were computed using free software's such as PAST™. Fernando's Biodiversity Scale (Fernando et al, 1998) was used in interpreting the computed diversity indices (**Table 2-5**).

Table 2-5 Fernando's Biodiversity Scale

RELATIVE VALUES	SHANNON-WEINER INDEX (H')	EVENNESS
Very High	3.5 - 4.0	0.75 – 1.0
High	3.0 – 3.49	0.5 – 0.74
Moderate	2.5 – 2.9	0.25 – 0.49
Low	2.0 – 2.49	1.15 – 0.24
Very Low	1.99 and below	0.14 and below

Computation for the Total Basal Area

The Basal Area (BA) is the cross-sectional area of a tree calculated from the tree's Diameter at Breast Height (DBH) in centimeters using the formula:

$$Basal\ Area\ (BA) = \pi r^2$$

Where: π = 3.142

r = radius

= DBH (cm)/200

This formula also converts the diameter in centimeters to the basal area in square meters. The Stand Basal Area (m^2/ha) was computed by adding the Basal Area (BA) of each tree divided by the area of the plot, to wit:

$$Stand\ Basal\ Area\ = \frac{Sum\ of\ the\ Basal\ Area\ (BA)\ in\ plot\ (m^2)}{Area\ of\ the\ plot\ (ha)}$$

2.1.4.1.2 Results and Discussion

Vegetation Structure

A total of 86 species from 83 genera and 51 families of trees, shrubs, herbs, grasses and vines were observed in the proposed project area located in Brgy. Alion, Brgy. Lucanin and Brgy. Townsite in Mariveles, Bataan. The species were found within and in the vicinity of the sampling plots and includes species noted through ethnobiological accounts and secondary data. In terms of habit, trees were the most represented with 42 species followed by shrubs, grasses, and vines with 19, eight (8) and six (6) species observed respectively (**Table 2-6**). The complete list of all observed species within the area are shown in **Table 2-7**. Photographs of some of the observed tree and other plant species within and in the vicinity of the sampling plots are shown in **Plate 2-2** and **Plate 2-3**.

Malvaceae (flowering plants) was the most represented family with 12 species. This is followed by Fabaceae (legumes, peas, and beans family) and Poaceae (monocotyledonous grass family), which were represented by 10 and seven (7) species respectively. Moraceae (mulberry and figs family), Lamiaceae (mint and sage family), Sapindaceae (soapberry family) were represented by five (5) species each. Total number of species per family is shown in **Figure 2-18**.

Table 2-6 Number of species, genus, and family per plant habit

HABIT	SPECIES	GENUS	FAMILY
Trees	42	40	22
Shrubs	19	18	12
Grasses	8	8	2
Vines	6	6	6
Herbs	5	5	4
Weed	3	3	3
Palms	2	2	1
Legumes	1	1	1
Total	**86**	**83**	**51**

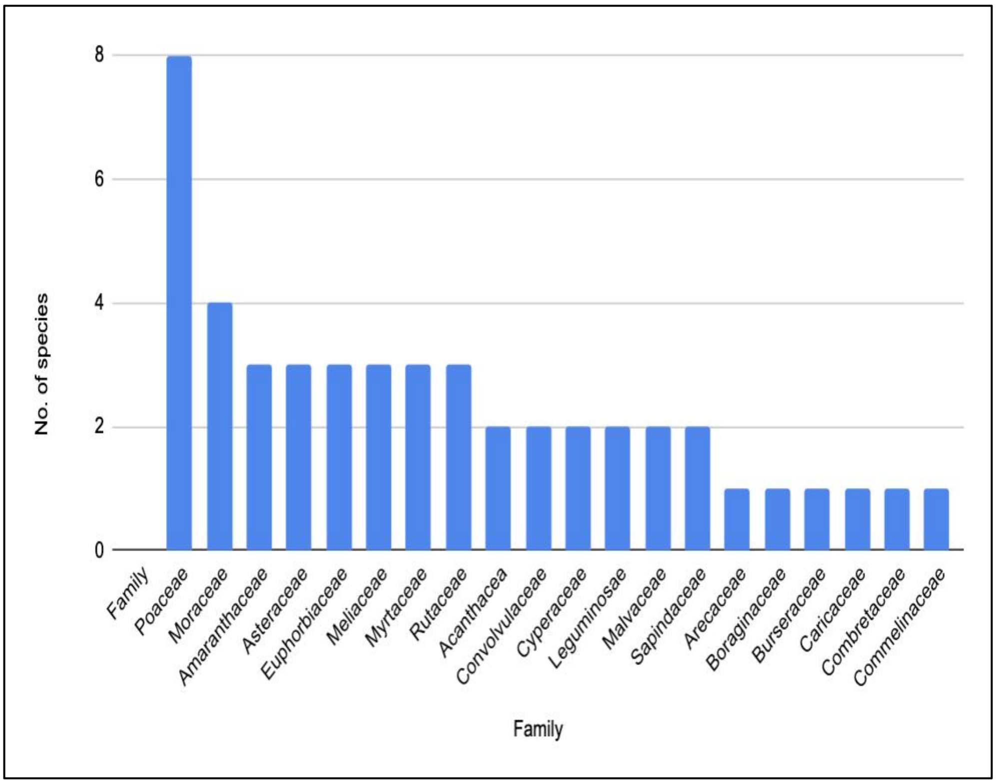

Figure 2- 18 Number of species per family

Plate 2- 2 Some of the observed tree species in the area: a.) Lagerstroemia speciosa; b.) Macaranga tanarius; c.) Ficus ulmifolia; d.) Vitex parviflora; e.) Gliricidia sepium; f.) Pittosporum pentandrum; g.)Artocarpus blancoi; h.) Canarium asperum ; i.) Swietenia macrophylla

Plate 2- 3 Some of the observed ground cover species: a.) *Triumfetta rhomboidea*; b.) *Elephantopus tomentosus*; c.) *Centrosema molle*; d.) *Ipomoea hederifolia*; e.) *Stachytarpheta jamaicensis*; f.) *Calopogonium mucunoides*

Table 2-7 Plant species observed within the plots and their description and conservation status

	FAMILY	SCIENTIFIC NAME	COMMON NAME	HABIT	RANGE	IUCN STATUS	DAO 2017-11	CITES
1	Anacardiaceae	*Anacardium occidentale* Linn.	Kasuy	Tree	Introduced	Least Concern	-	-
2	Anacardiaceae	*Buchanania arborescens* (Blume) Blume	Balinghasai	Tree	Native	Least Concern	-	-
3	Anacardiaceae	*Semecarpus cuneiformis*	Ligas	Tree	Native	-	-	-
4	Apocynaceae	*Wrightia pubescens* R. Br.	Lanete	Tree	Native	Least Concern	-	-
5	Apocynaceae	*Tabernaemontana pandacaqui* Poir.	Pandakaking-puti	Shrub	Native	Least Concern	-	-
6	Arecaceae	*Cocos nucifera* Linn.	Niyog	Palm	Introduced	No data	-	-
7	Arecaceae	*Caryota cumingii* Lodd. ex Mart.	Pugahan	Palm	Native	Data Deficient	-	-
8	Asteraceae	*Chromolaena odorata* Linn.	Hagonoy	Shrub	Invasive	-	-	-
9	Boraginaceae	*Cordia dichotoma* Forst. f.	Anonang	Tree	Native	Least Concern	-	-
10	Burseraceae	*Canarium asperum* Benth.	Pagsahingin	Tree	Native	Least Concern	-	-
11	Compositae	*Elephantopus tomentosus* L.	Malatabako	shrub	Introduced	-	-	-
12	Convolvulaceae	*Ipomoea hederifolia* (L.) Roth	Kamokamotihan	Vine	Introduced	-	-	-
13	Dilleniaceae	*Tetracera scandens* (L.) Merr.	Malakatmon	Vine	Native	-	-	-
14	Dombeyaceae	*Pterospermum celebicum Miq.*	Bayok-bayokan	tree	Native	-	-	-
15	Ebenaceae	*Diospyros pilosanthera* Blanco	Bolongeta	Tree	Native	-	Vulnerable	App II
16	Euphorbiaceae	*Macaranga tanarius (L.) Müll.Arg.*	Binunga	Tree	Native	Least Concern	-	-

	FAMILY	SCIENTIFIC NAME	COMMON NAME	HABIT	RANGE	IUCN STATUS	DAO 2017-11	CITES
17	Euphorbiaceae	*Mallotus philippensis* (Lam.) Muell.-Arg.	Banato	Tree	Native	Least Concern	-	-
18	Euphorbiaceae	*Macaranga grandifolia (Blanco) Merr.*	Takip asin	shrub	Endemic	Vulnerable	-	-
19	Fabaceae	*Leucaena leucocephala (Lam.) de Wit*	Ipil-ipil	Tree	Introduced	-	-	-
20	Fabaceae	*Gliricidia sepium (Jacq.) Steud.*	Kakawate	Tree	Introduced	Least Concern	-	-
21	Fabaceae	*Acacia auriculiforis Benth.*	Auri	Tree	Introduced	No data	-	-
22	Fabaceae	*Parkia javanica (Lam.) Merr.*	Kupang	Tree	Native	Least Concern	-	-
23	Fabaceae	*Albizia saman (Jacq.) F. Muell.*	Rain tree	Tree	Introduced	No data	-	-
24	Fabaceae	*Centrosema molle* Mart. ex Benth	Pukingan	Vine	Introduced	-	-	-
25	Fabaceae	*Calopogonium mucunoides* Desv.	Santing	Legume	Introduced	-	-	-
26	Fabaceae	*Ormosia calavensis* Azaola ex Blanco	Bahai	Tree	Native	-	-	-
27	Fabaceae	*Phyllodium pulchellum* (Linnaeus) Desvaux	Payang-payang	Shrub	Native	Least Concern	-	-
28	Fabaceae	*Tamarindus indica* Linn.	Sampalok	Tree	Introduced	-	-	-
29	Flagellariaceae	*Flagellaria indica* L.	Baling-uai	Vine	Native	-	-	-
30	Lamiaceae	*Gmelina arborea* Roxb.	Yemane	Tree	Introduced	Least Concern	-	-
31	Lamiaceae	*Premna odorata* Blanco	Alagaw	Tree	Native	Least Concern	-	-
32	Lamiaceae	*Vitex parviflora* Juss.	Molave	Tree	Native	Least Concern	Endangered	-
33	Lamiaceae	*Clerodendrum minahassae* Teijsm. & Binn.	Bagauak puti	Shrub	Native	-	-	-

	FAMILY	SCIENTIFIC NAME	COMMON NAME	HABIT	RANGE	IUCN STATUS	DAO 2017-11	CITES
34	Lamiaceae	*Mesosphaerum suaveolens* (L.) Kuntze	Suob-kabayo	Weed	Introduced	-	-	-
35	Lauraceae	*Litsea glutinosa* (Lour.) C.B.Rob.	Sablot	Tree	Native	-	-	-
36	Lauraceae	*Persea americana* Mill.	Avocado	tree	Introduced	Least Concern	-	-
37	Leguminosae	*Pithecellobium dulce (Roxb.) Benth.*	Kamachile	Tree	Introduced	Least Concern	-	-
38	Leguminosae	*Crotalaria retusa* Linn.	Kalog-kalog	Weed	Introduced	-	-	-
39	Leguminosae	*Pueraria montana* (Lour.) Merr.	Kudzu	vine	Native	-	-	-
40	Lygodiaceae	*Lygodium circinnatum (Burm. f.) Sw.*	Nito	Herb	Native	-	-	-
41	Lythraceae	*Lagerstroemia speciosa* (L.) Pers.	Banaba	Tree	Native	-	-	-
42	Malvaceae	*Triumfetta rhomboidea* Jacq.	Kulutkulutan	Shrub	Introduced	-	-	-
43	Malvaceae	*Ceiba pentandra* (L.) Gaertn	Kapok	Tree	Introduced	Least Concern	-	-
44	Malvaceae	*Pterocymbium tinctorium*	Taluto	Tree	Native	Least Concern	-	-
45	Malvaceae	*Azanza lampas* (Cav.) Alef.	Marakapas	Shrub	Native	-	-	-
46	Malvaceae	*Corchorus olitorius* L.	Pasau	Shrub	Native	-	-	-
47	Malvaceae	*Kleinhovia hospital* L.	Tan-ag	Tree	Native	Least Concern	-	-
48	Malvaceae	*Malachra fasciata* Jacq.	Paang-baliwis	Herb	Introduced	-	-	-
49	Malvaceae	*Malvastrum americanum* (L.) Torr.	Salsaluyot	Herb	Introduced	-	-	-
50	Malvaceae	*Pterocymbium tinctorium* Merr.	Taluto	Tree	Native	Least Concern	-	-
51	Malvaceae	*Sida rhombifolia* L.	Escobilla	Shrub	Native	-	-	-

	FAMILY	SCIENTIFIC NAME	COMMON NAME	HABIT	RANGE	IUCN STATUS	DAO 2017-11	CITES
52	Malvaceae	*Sterculia foetida* L.	Kalumpang	Tree	Native	-	-	-
53	Malvaceae	*Urena lobata* L.	Dalupang	Shrub	Native	Least Concern	-	-
54	Meliaceae	*Swietenia macrophylla King*	Mahogany	Tree	Introduced/ Invasive	Vulnerable	-	App II
55	Menispermaceae	*Tinomiscium petiolare* Hook. f. & Thomson	Bayating	Vine	Endemic	-	-	-
56	Mimosaceae	*Mimosa pudica* Linn.	Makahiya	Weed	Introduced	Least Concern	-	-
57	Moraceae	*Ficus septica* Burm.f.	Hauili	Tree	Native	Least Concern	-	-
58	Moraceae	*Ficus nota* (Blanco) Merr.	Tibig	Tree	Native	Least Concern	-	-
59	Moraceae	*Ficus ulmifolia Lam.*	Isis	Shrub	Endemic	Vulnerable	-	-
60	Moraceae	*Artocarpus blancoi* (Elmer) Merr.	Antipolo	Tree	Endemic	Least Concern	-	-
61	Moraceae	*Streblus asper* Lour.	Kalios	Tree	Native	Least Concern	-	-
62	Musaceae	*Musa x paradisiaca* L.	Saging	Herb	Introduced	-	-	-
63	Myrtaceae	*Psidium guajava L.*	Bayabas	Tree	Introduced	Least Concern	-	-
64	Myrtaceae	*Syzygium cumini (L.) Skeels*	Duhat	Tree	Introduced	Least Concern	-	-
65	Oleaceae	*Chionanthus ramiflorus* Roxb.	Karaksan	Shrub	Native	-	-	-
66	Opiliaceae	*Champereia manillana* (Blume) Merr.	Liyong-liyong	Shrub	Native	Least Concern	-	-
67	Phyllantaceae	*Antidesma ghaesembilla* Gaertn.	Binayuyo	Tree	Native	Least Concern	-	-
68	Phyllanthaceae	*Bridelia glauca* Blume	Anislag	Tree	Native	Least Concern	-	-
69	Pittosporaceae	*Pittosporum pentandrum* (Blanco) Merr.	Mamalis	tree	Native	-	-	-

	FAMILY	SCIENTIFIC NAME	COMMON NAME	HABIT	RANGE	IUCN STATUS	DAO 2017-11	CITES
70	Poaceae	*Isachne albens* Trin.	Running mountaingrass	Grass	Native	Least Concern	-	-
71	Poaceae	*Oplismenus compositus* (L.) P.Beauv.	Running mountaingrass	Grass	Native	Least Concern	-	-
72	Poaceae	*Paspalum conjugatum* P.J.Bergius	Kauad-kauaran	Grass	Introduced/Invasive	Least Concern	-	-
73	Poaceae	*Pogonatherum crinitum* (Thunb.) Kunth	Bamboo grass	Grass	Native	-	-	-
74	Poaceae	*Saccharum spontaneum* L.	Talahib	Grass	Native	Least Concern	-	-
75	Poaceae	*Bambusa blumeana* Schult.f.	Kawayan tinik	grass	Introduced	-	-	-
76	Poaceae	*Dinochloa acutiflora* (Munro) Soenarko	Bikal	grass	Native		OTS	-
77	Rubiaceae	*Ixora philippinensis* Merr.	Kayomyom	Grass	Native	-	-	-
78	Sapindaceae	*Mangifera indica* Linn.	Mangga	Tree	Introduced	Data Deficient	-	-
79	Sapindaceae	*Alectryon glaber* (Blume) Radlk.	Ibu	Shrub	Native	Least Concern	-	-
80	Sapindaceae	*Allophylus dimorphus* Radlk.	Malalagundi	Shrub	Native	-	-	-
81	Sapindaceae	*Guioa koelreuteria* (Blanco) Merr.	Salab	Tree	Native	Least Concern	-	-
82	Sapindaceae	*Lepisanthes fruticosa* (Roxb.) Leenh	Balinaunau	Shrub	Native	Least Concern	-	-
83	Sapotaceae	*Chrysophyllum cainito* L.	Caimito	Tree	Introduced	Least Concern	-	-
84	Taccaceae	*Tacca palmata* Blume	Payung- payungan	Herb	Native	-	-	-
85	Verbenacea	*Stachytarpheta jamaicensis* (L.) Vahl	Kandikandilaan	Shrub	Introduced	Least Concern	-	-
86	Verbenaceae	*Lantana camara* L.	Lantana	Shrub	Introduced/Invasive	-	-	-

Legend: App II = Appendix II (CITES); OTS = Other Threatened Species

In terms of plant species distribution, majority of the observed species are native (58.14%, 50 species), in which they are found to occur in the Philippines and other parts of the world. A large portion of observed native species are trees (26 species) followed by shrubs (12 species) (**Table 2-8**). In contrast, introduced species also abound the area (32.56%, 28 species). Endemic plant species or species found only in the Philippines, comprise 4.65% (4 species) while invasive species, which threaten native and endemic species, are about 4.65% (4 species). The relative percentage of plant habit by distribution is illustrated in **Figure 2-19**.

Table 2-8 Number of species by distribution per plant habit

HABIT	NATIVE	INTRODUCED	ENDEMIC	INVASIVE	TOTAL
Tree	26	14	1	1	42
Shrub	11	4	2	2	19
Grass	6	1	-	1	8
Vine	3	2	1	-	6
Herb	2	3	-	-	5
Weed	-	3	-	-	3
Palm	1	1	-	-	2
Legume	-	1	-	-	1
Total	**50**	**28**	**4**	**4**	86

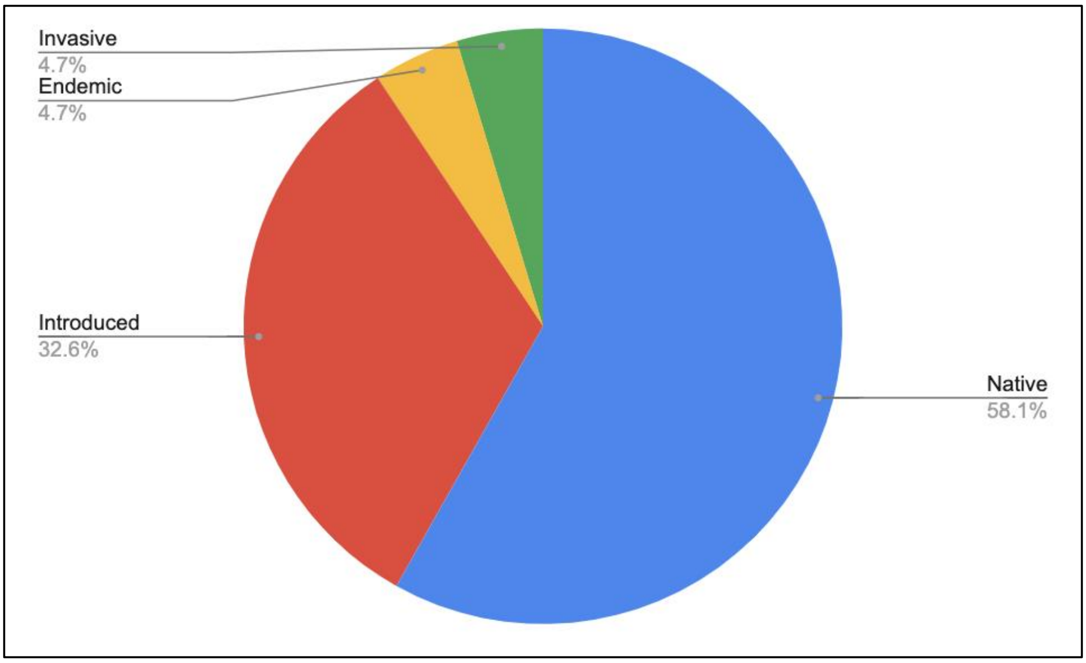

Figure 2-19 Percentage of species by distribution

Among the endemic species observed in the project area are: *Ficus ulmifolia Lam.* (isis), *Macaranga grandifolia* (Blanco) Merr. (takip-asin), *Artocarpus blancoi* (Elmer) Merr. (antipolo) and *Tinomiscium petiolare* Hook. f. & Thomson (bayating).

There were also four (4) observed species which were identified to be invasive in the Philippines according to the Centre for Agriculture and Biosciences International (CABI): *Chromolaena odorata* Linn. (hagonoy), *Lantana camara* L. (lantana), *Paspalum conjugatum* P.J.Bergius (Kauad-Kauaran) and *Swietenia macrophylla* King (mahogany). Some of these species are shown in **Plate 2-4**.


Plate 2-4 Some of the most common invasive species in the proposed project site a.) *Lantana camara* and b.) *Chromolaena odorata*

Majority of the listed species are categorized as 'Least Concern' (46.51%, 40 species) by the International Union for Conservation of Nature (IUCN). However, about the same number of species were not listed under the IUCN (47.67%, 41 species). There were three (3) species identified as 'Vulnerable' (3.49%) and two (2) species categorized as 'Data deficient' (2.33%) (**Figure 2-20).**

The listed vulnerable species are: Ficus ulmifolia Lam. (isis), Macaranga grandifolia (Blanco) Merr. (takip-asin), and Swietenia macrophylla King (mahogany). F. ulmifolia has been categorized as 'Vulnerable' due to its endemicity and reliance on a specialized wasp to reproduce (Tropical Plants Database). M. grandifolia is also an endemic species particularly in the island of Luzon. It should be noted however, that S. macrophylla is classified as vulnerable in its native range while it is considered as an invasive species in the Philippines since its introduction during the 1900s (Baguinon et al., 2005).

S. macrophylla and Diospyros pilosanthera Blanco (bolongeta) were also categorized by the Convention on International Trade in Endangered Species (CITES) under Appendix II (**Table 2-7**).

Species belonging in this category are identified to be 'not necessarily threatened with extinction, but in which trade must be controlled to avoid utilization incompatible with their survival.

There were also several species listed in DAO 2017-11 (Updated National List of Threatened Philippine Plants and their Categories) such as: Vitex parviflora Juss. (molave) as 'Endangered,' D. pilosanthera as 'Vulnerable' and Dinochloa acutiflora (Munro) Soenarko (bikal) as 'Other Threatened Species.

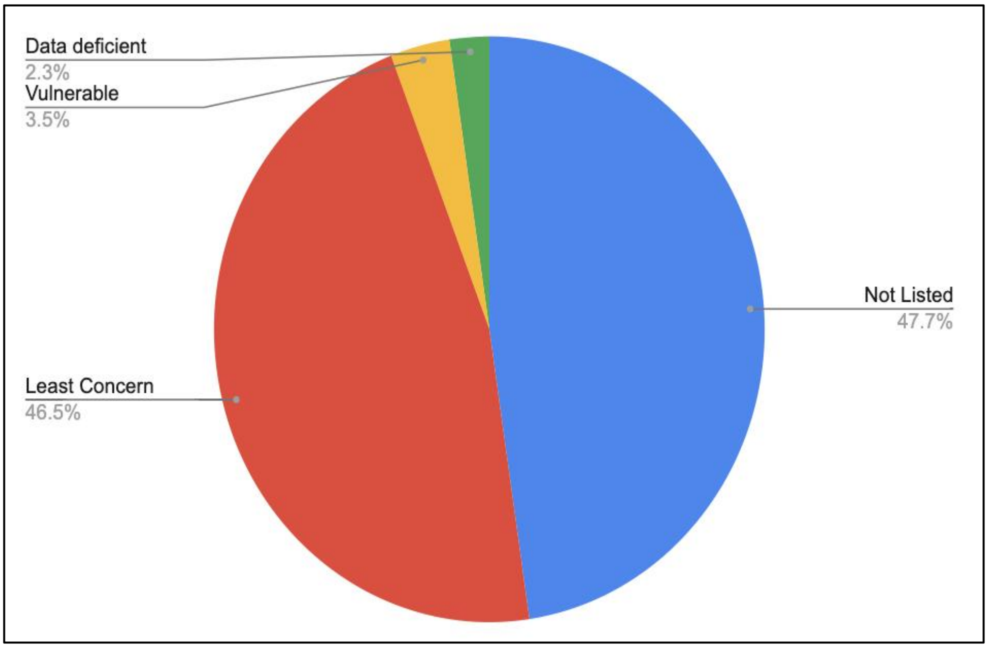

Figure 2-20 Percentage of species by IUCN status

Economic Importance and Uses of Flora

All observed species were categorized based on their usage/economic importance as published in the literature (

Table 2-9). Majority of the observed species (n=67) are used as medicine or have medicinal properties (**Figure 2-21**). About 37 plant species have different plant parts that were recorded to be eaten as food. There were also 35 species which are noted to be sources of extractive products or are sources of other derived products. These include plant species which are used as dyes, extracted for essential oils, resin, colorants, and textile/fiber. Other observed usage of the species include: construction materials (n=21), Feed for livestock, (n=15), fuelwood/charcoal (n=12), furniture making (n=6), rope (n=9) and paper (n=6).

Table 2-9 Uses of all observed plant species based from literature

FAMILY	SCIENTIFIC NAME	COMMON NAME	USES
Anacardiaceae	*Anacardium occidentale* Linn.	Kasuy	a, b, c, d, i
Anacardiaceae	*Buchanania arborescens* (Blume) Blume	Balinghasai	a, b, c
Anacardiaceae	*Semecarpus cuneiformis*	Ligas	a
Apocynaceae	*Wrightia pubescens* R. Br.	Lanete	a, b, f, i
Apocynaceae	*Tabernaemontana pandacaqui* Poir.	Pandakaking-puti	a
Arecaceae	*Cocos nucifera* Linn.	Niyog	a, b, e, l
Arecaceae	*Caryota cumingii* Lodd. ex Mart.	Pugahan	a, c, o
Asteraceae	*Chromolaena odorata* Linn.	Hagonoy	a, n
Boraginaceae	*Cordia dichotoma* Forst. f.	Anonang	a, b, e, f, g, o
Burseraceae	*Canarium asperum* Benth.	Pagsahingin	c, e
Compositae	*Elephantopus tomentosus* L.	Malatabako	e
Convolvulaceae	*Ipomoea hederifolia* (L.) Roth	Kamokamotihan	a
Dilleniaceae	*Tetracera scandens* (L.) Merr.	Malakatmon	a
Dombeyaceae	*Pterospermum celebicum Miq.*	Bayok-bayokan	a, c, e, o
Ebenaceae	*Diospyros pilosanthera* Blanco	Bolongeta	a, b, f,
Euphorbiaceae	*Macaranga tanarius (L.) Müll.Arg.*	Binunga	a, b, e, c, i
Euphorbiaceae	*Mallotus philippensis* (Lam.) Muell.-Arg.	Banato	a, g, i, l, o
Euphorbiaceae	*Macaranga grandifolia (Blanco) Merr.*	Takip asin	a, b, c
Fabaceae	*Leucaena leucocephala (Lam.) de Wit*	Ipil-ipil	c, b, g, i
Fabaceae	*Gliricidia sepium (Jacq.) Steud.*	Kakawate	a, d, e, h, g, m
Fabaceae	*Acacia auriculiforis Benth.*	Auri	a, c, e, g, k
Fabaceae	*Parkia javanica (Lam.) Merr.*	Kupang	a, b, c
Fabaceae	*Albizia saman (Jacq.) F. Muell.*	Rain tree	b, c, d, f, g,
Fabaceae	*Centrosema molle* Mart. ex Benth	Pukingan	a, d
Fabaceae	*Calopogonium mucunoides* Desv.	Santing	p
Fabaceae	*Ormosia calavensis* Azaola ex Blanco	Bahai	a
Fabaceae	*Phyllodium pulchellum* (Linnaeus) Desvaux	Payang-payang	a, b
Fabaceae	*Tamarindus indica* Linn.	Sampalok	a, b, c, d, e,

FAMILY	SCIENTIFIC NAME	COMMON NAME	USES
Flagellariaceae	*Flagellaria indica* L.	Baling-uai	c
Lamiaceae	*Gmelina arborea* Roxb.	Yemane	e, f
Lamiaceae	*Premna odorata* Blanco	Alagaw	a, b, c
Lamiaceae	*Vitex parviflora* Juss.	Molave	a, b, e, g
Lamiaceae	*Clerodendrum minahassae* Teijsm. & Binn.	Bagauak puti	a, b, k
Lamiaceae	*Mesosphaerum suaveolens* (L.) Kuntze	Suob-kabayo	a
Lauraceae	*Litsea glutinosa* (Lour.) C.B.Rob.	Sablot	a, b, d
Lauraceae	*Persea americana* Mill.	Avocado	a, b
Leguminosae	*Pithecellobium dulce (Roxb.) Benth.*	Kamachile	a, b
Leguminosae	*Crotalaria retusa* Linn.	Kalog-kalog	b, p
Leguminosae	*Pueraria montana* (Lour.) Merr.	Kudzu	a, b, j, c, o
Lygodiaceae	*Lygodium circinnatum (Burm. f.) Sw.*	Nito	a, c
Lythraceae	*Lagerstroemia speciosa* (L.) Pers.	Banaba	a, c, e,
Malvaceae	*Triumfetta rhomboidea* Jacq.	Kulutkulutan	a, b, c
Malvaceae	*Ceiba pentandra* (L.) Gaertn	Kapok	a, b, c, d, f
Malvaceae	*Pterocymbium tinctorium*	Taluto	a, c, e, o
Malvaceae	*Azanza lampas* (Cav.) Alef.	Marakapas	a
Malvaceae	*Corchorus olitorius* L.	Pasau	a, b
Malvaceae	*Kleinhovia hospital* L.	Tan-ag	a, c
Malvaceae	*Malachra fasciata* Jacq.	Paang-baliwis	c
Malvaceae	*Malvastrum americanum* (L.) Torr.	Salsaluyot	a, d
Malvaceae	*Pterocymbium tinctorium* Merr.	Taluto	c
Malvaceae	*Sida rhombifolia* L.	Escobilla	a, d
Malvaceae	*Sterculia foetida* L.	Kalumpang	a, c
Malvaceae	*Urena lobata* L.	Dalupang	c
Meliaceae	*Swietenia macrophylla King*	Mahogany	a, e, c, g
Menispermaceae	*Tinomiscium petiolare* Hook. f. & Thomson	Bayating	a
Mimosaceae	*Mimosa pudica* Linn.	Makahiya	a
Moraceae	*Ficus septica* Burm.f.	Hauili	a
Moraceae	*Ficus nota* (Blanco) Merr.	Tibig	a, b, g
Moraceae	*Ficus ulmifolia Lam.*	Isis	a, b
Moraceae	*Artocarpus blancoi* (Elmer) Merr.	Antipolo	a, b, c, e, h

Family	Scientific Name	Common Name	Uses
Moraceae	*Streblus asper* Lour.	Kalios	a, b, c
Musaceae	*Musa x paradisiaca* L.	Saging	a, b
Myrtaceae	*Psidium guajava L.*	Bayabas	a, b, e, c, g, l
Myrtaceae	*Syzygium cumini (L.) Skeels*	Duhat	a, b, e
Oleaceae	*Chionanthus ramiflorus* Roxb.	Karaksan	c
Opiliaceae	*Champereia manillana* (Blume) Merr.	Liyong-liyong	a, c
Phyllantaceae	*Antidesma ghaesembilla* Gaertn.	Binayuyo	a, b, e
Phyllanthaceae	*Bridelia glauca* Blume	Anislag	a
Pittosporaceae	*Pittosporum pentandrum* (Blanco) Merr.	Mamalis	a, c, g
Poaceae	*Isachne albens* Trin.	Running mountaingrass	d
Poaceae	*Oplismenus compositus* (L.) P.Beauv.	Running mountaingrass	d
Poaceae	*Paspalum conjugatum* P.J.Bergius	Kauad-kauaran	d, k
Poaceae	*Pogonatherum crinitum* (Thunb.) Kunth	Bamboo grass	a, d
Poaceae	*Saccharum spontaneum* L.	Talahib	d
Poaceae	*Bambusa blumeana* Schult.f.	Kawayan tinik	b, e, g, i, j
Poaceae	*Dinochloa acutiflora* (Munro) Soenarko	Bikal	e
Rubiaceae	*Ixora philippinensis* Merr.	Kayomyom	a, k
Sapindaceae	*Mangifera indica* Linn.	Mangga	a, b, c
Sapindaceae	*Alectryon glaber* (Blume) Radlk.	Ibu	c
Sapindaceae	*Allophylus dimorphus* Radlk.	Malalagundi	a
Sapindaceae	*Guioa koelreuteria* (Blanco) Merr.	Salab	a, c
Sapindaceae	*Lepisanthes fruticosa* (Roxb.) Leenh	Balinaunau	a, b
Sapotaceae	*Chrysophyllum cainito* L.	Caimito	a, b
Taccaceae	*Tacca palmata* Blume	Payung- payungan	a
Verbenacea	*Stachytarpheta jamaicensis* (L.) Vahl	Kandikandilaan	a, b, d
Verbenaceae	*Lantana camara* L.	Lantana	a, e

Legend: *a. Medicinal; b. Food/drink; c. source of product; d. feed; e. construction; f. furniture; g. fuel; i. Paper; j. erosion control; k. landscaping/ornamentsl; l. cosmetics; m. pesticide; n. aquaculture*

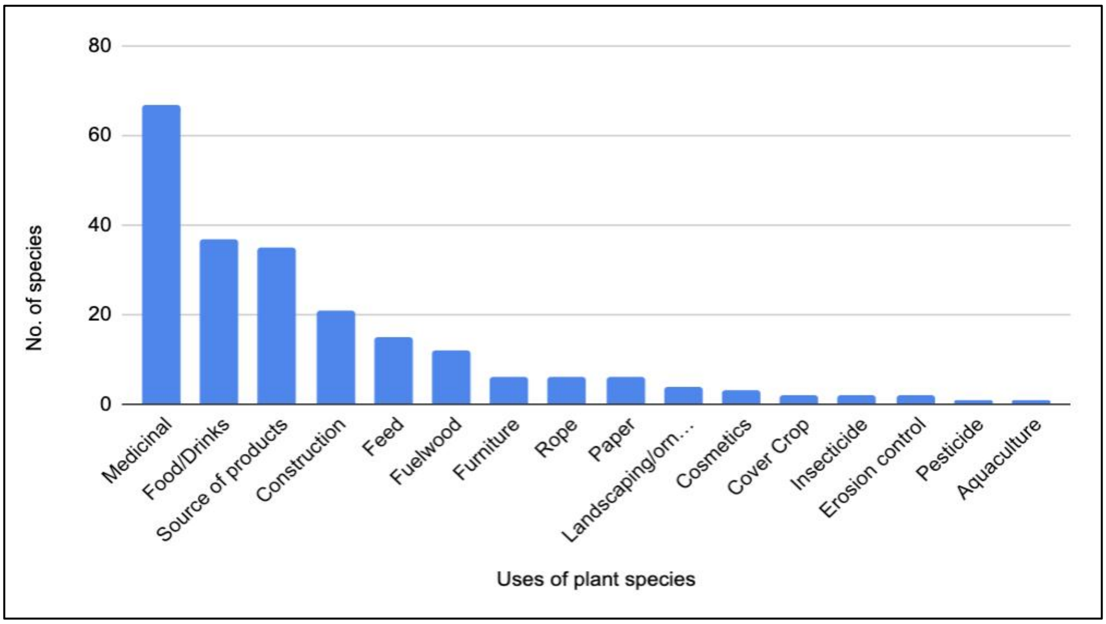

Figure 2-21 Number of plant species by usage

Tree diversity

A total of 103 individual trees (DBH > 5cm) belonging to 11 species and nine (9) families were intercepted within the established nine (9) sampling plots. The species of tree with the most number of individuals are: Gliricidia sepium (Jacq.) Steud. (kakawate) with 49 individuals followed by Antidesma ghaesembilla Gaertn. (binayuyo) and Lagerstroemia speciosa (L.) Pers. (banaba) with 23 and 11 species respectively.

Family Fabaceae (legumes, peas, and beans family) and Myrtaceae (myrtle family) are the most represented families with two (2) species each. All other families are represented by one (1) species each.

Importance Values

Importance Values (IV) is an important quantitative description that gives an idea of what species of trees have the most effects on the ecological function of a given landscape. Higher IV indicates that a tree has a high role on important forest processes such as nutrient cycling and carbon sequestration.

Density is the total number of individuals of each species in all the quadrats divided by the total size of quadrats studied. Relative density measures the density of the plant species in all of the quadrat assessed. It is the numerical strength of a species in relation to the total number of individuals of all the species.

Frequency refers to the degree of dispersion of individual species in an area and usually expressed in terms of percentage occurrence. Relative frequency compares the absolute frequency of a species to the frequencies of all species found on the plots. It is the degree of dispersion of individual species in an area in relation to the number of all the species that occurred.

Dominance of a species is determined by the value of the basal cover while relative dominance is the coverage value of a species with respect to the sum of coverage of the rest of the species in the area.

Table 2-10 shows the summarized list of Importance Values of trees (DBH>10cm) found in the area. The highest IV was computed for *G. sepium* with 90.98%. The species was also found to have the highest relative density and relative frequency. *A. ghaesembilla* and *L. speciosa* were the co-dominant species based on their computed IV. *L. speciosa* was also noted to have the highest relative dominance among the sampled tree species. Least dominant species based on IV are: *Canarium asperum* Benth. (pagsahingin), *Psidium guajava* L. (bayabas) and *Acacia auriculiforis* Benth (auri).

Table 2-10 Summary of Importance values of tree species assessed

FAMILY	SCIENTIFIC NAME	COMMON NAME	RELATIVE DOMINANCE (%)	RELATIVE DENSITY (%)	RELATIVE FREQUENCY (%)	IMPORTANCE VALUE (%)
Fabaceae	*Gliricidia sepium*	Kakawate	14.84	47.57	28.57	90.98
Phyllantaceae	*Antidesma*	Binayuyo	17.86	22.33	23.81	64.00
Lythraceae	*Lagerstroemia*	Banaba	30.82	10.68	4.76	46.26
Myrtaceae	*Syzygium cumini*	Duhat	16.41	7.77	4.76	28.94
Apocynaceae	*Wrightia*	Lanete	1.39	3.88	9.52	14.79
Malvaceae	*Pterocymbium*	Taluto	6.25	0.97	4.76	11.98
Euphorbiaceae	*Macaranga*	Binunga	4.94	0.97	4.76	10.67
Anacardiaceae	*Anacardium*	Kasuy	3.42	1.94	4.76	10.12
Fabaceae	*Acacia*	Auri	2.78	0.97	4.76	8.51
Myrtaceae	*Psidium guajava*	Bayabas	0.19	1.94	4.76	6.89
Burseraceae	*Canarium*	Pagsahingin	1.11	0.97	4.76	6.85
TOTAL			**100**	**100**	**100**	**300**

Intermediate and Understory

Poles and saplings or young tree species that are less than 5cm in DBH but are greater than 2cm were also assessed. These are relatively younger trees that are not considered timber size yet. These species are indicators of reproduction of a species that might affect the overall diversity indices and stand structure of the forest.

A total of seven (7) species from seven (6) families were observed to be at their sapling stage in all sampling plots. Two (2) species were noted to occur in multiple plots which are: Streblus asper Lour. (kalios) Buchanania arborescens (Blume) (balinghasai), the former having the most number of individual saplings observed (**Table 2-11**).

Table 2-11 Summary of pole species (5cm>DBH>2cm) observed in the plots

FAMILY	SCIENTIFIC NAME	COMMON NAME	PLOTS	NO. OF INDIVIDUALS
Moraceae	Streblus asper Lour.	Kalios	3	6
Anacardiaceae	Buchanania arborescens (Blume)	Balinghasai	2	2
Phyllantaceae	Antidesma ghaesembilla Gaertn.	Binayuyo	1	2
Burseraceae	Canarium asperum Benth.	Pagsahingin	1	2
Moraceae	Artocarpus blancoi (Elmer) Merr.	Antipolo	1	1
Lythraceae	Lagerstroemia speciosa (L.) Pers.	Banaba	1	1
Meliaceae	Swietenia macrophylla King	Mahogany	1	1

Regenerants and Ground cover

Regenerants or young tree species in which their diameter are less than 2 cm were also noted in each sampling plot. These regenerants comprise the cohorts for regeneration potential of the stands. In addition, these species are crucial since these can be sources of materials for reforestation purposes and are also indicators of successes of repopulation of a species. The assessment reveals only a total of three (3) species from two (2) families were observed in all plots (**Table 2-12**) with Artocarpus heterophyllus Lam. (langka) having the highest number of individuals.

Table 2-12 Summary of regenerants (diameter>2cm) observed in the plots

FAMILY	SCIENTIFIC NAME	COMMON NAME	PLOTS	NO. OF
Moraceae	*Streblus asper* Lour.	Kalios	3	6
Anacardiaceae	*Buchanania arborescens*	Balinghasai	2	2
Phyllantaceae	*Antidesma ghaesembilla* Gaertn.	Binayuyo	1	2
Burseraceae	*Canarium asperum* Benth.	Pagsahingin	1	2
Moraceae	*Artocarpus blancoi* (Elmer) Merr.	Antipolo	1	1
Lythraceae	*Lagerstroemia speciosa* (L.)	Banaba	1	1
Meliaceae	*Swietenia macrophylla King*	Mahogany	1	1

For ground cover, a total of 14 species from 10 families were identified within the sampling plots (**Table 2-13**). Specifically, five (5) species of herbs, four (4) species of grasses, three (3) species of trees and two (2) vines. In terms of the number of species, a large portion of ground cover are grasses: Paspalum conjugatum P.J.Bergius (Kauad-kauaran) and Eragrostis tenella (L.) Roem. & Schult. (Bakinuk). Also co-dominating the sampling plots is an herb, Synedrella nodiflora (L.) Gaertn. (tuhod-manok). S. nodiflora, which was observed in 3 out of 7 plots, was identified to be an invasive species in the Philippines by the Centre for Agriculture and Biosciences International (CABI). It is also among the common and economically important weed species of cash crops and other vegetables in the Philippines (Donayre et al., 2019).

Table 2-13 Ground cover species identified in the sampling plots

FAMILY	SCIENTIFIC NAME	COMMON NAME	INDIVIDUALS	RELATIVE (%) COVER
Poaceae	*Paspalum conjugatum*	Kauad-kauaran	107	26.44
Asteraceae	*Chromolaena odorata* Linn.	Hagonoy	32	22.44
Malvaceae	*Sida rhombifolia* L.	Escobilla	52	16.83
Poaceae	*Isachne albens* Trin.	Running	60	14.42
Malvaceae	*Triumfetta rhomboidea* Jacq.	Kulutkulutan	4	7.05
Apocynaceae	*Tabernaemontana pandacaqui*	Pandakaking-puti	7	4.81
Convolvulaceae	*Momordica charantia L. var.*	Ampalayang Ligaw	2	4.01
Verbenaceae	*Lantana camara* L.	Lantana	2	1.60
Verbenacea	*Stachytarpheta jamaicensis* (L.)	Kandikandilaan	1	1.60
Compositae	*Elephantopus tomentosus* L.	Malatabako	1	0.80

Diversity and Evenness

Different indices were used to determine the species diversity in the study site and these are: Species Richness, Shannon-Wiener Diversity Index (H'), Simpson's Index of Dominance (1-D), and Evenness (e^H/S). These diversity indices are important parameters to determine the number and abundance of the species in the community.

For the whole project site, the computed Shannon-Wiener diversity index (H') is 2.45 and the evenness value (e^H/S) is 0.41 (**Table 2-14**). Based on Fernando's Biodiversity Scale, the Shannon-Wiener and evenness values are low and both moderate respectively. In the specific sampling plots, the majority are characterized to have a very low diversity. The very low diversity values may be attributed to the dominance of some species such as G. sepium (kakawate). For evenness, the index which measures the relative abundance of each species, the values computed range from moderate (0.45) to very high (0.89) and majority of the plots have high evenness index values.

Almost all of the plots have high Simpson's Index values (near the value of 1). Simpson's index is a measure of diversity but takes into account the number and relative abundance of each species. The relatively higher Simpson's index value for the plots is attributed to the almost equal number of species in the plot. Margalef's richness index measures the number of species in the area. The highest species richness was observed in plots 1, 2, 5 and 6 (9 species) and the lowest in plot 3 (4 species) which correspondingly have the highest and lowest richness index values respectively.

In comparison with other published vegetation assessments in Bataan, the diversity in the study area is relatively lower. 'Very High' diversity was recorded in Minaritan, Morong, Bataan (H'=3.82) and Bataan Natural Park (H'=3.07-3.80) (Galias and Cuevas, 2008; Paz-Alberto et al., 2016). However, it was noted that the sampling area in the said studies were larger and are located at higher elevations (180-400 masl), hence, the observed higher diversity.

Table 2-14 Computed diversity indices for each sampling plot

PLOT	SHANNON DIVERSITY INDEX	SIMPSON DIVERSITY INDEX	PIELOU'S EVENNESS INDEX	MARGALEF RICHNESS INDEX
Plot 1	1.972	0.847	0.898	2.203
Plot 2	1.793	0.7674	0.6672	2.517
Plot 3	1.205	0.6627	0.834	1.17
Plot 4	1.403	0.6797	0.678	1.226
Plot 5	1.398	0.611	0.450	1.903
Plot 6	1.675	0.7338	0.593	2.102
Plot 7	1.186	0.5689	0.4678	1.542
Plot 8	1.605	0.7581	0.7115	1.344
Plot 9	1.587	0.7713	0.8147	1.237
Average	**2.486**	**0.8752**	**0.4143**	**4.627**

2.1.4.1.3 Possible Impacts of the Project

Removal of vegetation

Clearance of vegetation is expected since there will be construction of facilities prior to the conduct of project activities. The construction of access roads may also make way for encroachment which may cause further loss of vegetation. In effect, this may decrease the complexity and stratification of the habitat that will also affect the existing biodiversity that depends on it for food, shelter, and other utilities (Parker and Brown, 2000; Walther, 2002).

Loss of Local Species

Biological resources can also be affected by land use conversions, increased human activity in the vicinity, and increased pressure due to human population increase associated with the manpower. Encroachment may encourage the conversion of the remaining sparsely vegetated areas that will threaten existing biodiversity that these support. Species that may be threatened include those that have limited distribution or are endemic, and those that are classified as 'Vulnerable' by the International Union for the Conservation of Nature (IUCN).

Another threat to the local biodiversity is the presence of Invasive Alien Species (IAS). These are non-native organisms in an ecosystem that adversely impact biodiversity and may cause the decline or elimination of native species as well as disruption of ecosystem functions (Convention on Biological Diversity, 2021). IAS may compete with the native species in the area and since they are fast-growing and have high dispersal ability, they may potentially occupy the cleared areas in the project site.

Threat to species community structure

A high species richness in an ecosystem leads to greater stability and productivity. However, the clearance of vegetation due to the construction of facilities and access roads in the project site may limit the space for the establishment of other species and will affect the community structure in the area. Dominance of other species may also be established which will affect species richness. The lesser the species richness and abundance, the lesser the plant diversity and the lower is the capacity of the ecosystem/area to support other species and carry-out ecological functions (Cleland, 2011).

Soil erosion

The clearance of vegetation can also cause soil particles to be eroded, contributing to sediment build-up in nearby water bodies. Soil erosion refers to the transport of soil particles by water and wind and is aggravated by anthropogenic-linked causes such as poor soil management or removal of vegetation for agriculture or mining activities (Wantzen and Mol, 2013).

Vegetation or plant covers effectively increase the water holding capacity in soil (Duran-Suazo and Pleguezuelo, 2008), thus lessening soil erosion and maintaining soil quality. Therefore, keeping vegetation clearance at minimum and conducting rehabilitation and off-setting of vegetation can help mitigate soil erosion in the area.

2.1.4.1.4 Mitigation measures to reduce possible project impacts

Since the majority of the trees/plants identified are not threatened, the overall impact on the environment will be negligible. However, tree cutting must be avoided as much as possible to minimize disturbance to the immediate vegetation community. It should be clear that cutting of trees and clearing of vegetative cover is to be undertaken only when necessary. The proponent shall strictly comply with tree cutting permit regulations, reinforce buffer zones, reduce dust sources, and implement plans such as conservation corridor plans. Establishing a buffer corridor through the remaining vegetation patches along the project site can be reinforced, extended, or expanded to increase protection of sites for biodiversity and minimize project's impact because of its future operational activities, vehicle movements and constructions.

Access roads should also be constructed in the most strategic route that will minimize damage to local floral assemblage. For enhancement and adaptation, off-setting of lost vegetation in plantable areas can be done using native species.

To mitigate and off-set land use conversion, it is recommended to tag and map out the remaining vegetated portions of the project site and identify possible rehabilitation areas to improve vegetation using native and other important tree/plant species. Fencing, installment of signages, and increased security within the boundary of the project can also help in preventing encroachment.

Pest and weed management plan must also be developed to avoid further spread and proliferation of IAS. Lastly, monitoring of biodiversity through annual or semi-annual plant species inventory is also recommended.

2.1.4.2 Terrestrial Fauna

The terrestrial fauna survey was conducted to assess the existing terrestrial wildlife animals within the proposed Lucanin Multi-Tier Broiler Project located in Brgy. Lucanin, Mariveles, Bataan on January 13 – 14, 2023. Specifically, this survey aimed to 1) to conduct a rapid assessment of terrestrial wildlife animals (birds, mammals, reptiles, and amphibians) that are present within the perimeter of the proposed broiler farm; 2) identify possible impacts of the proposed project within the study area to the wildlife animals; and 3) to provide mitigating measures for the conservation of terrestrial wildlife animals prior to the development of the broiler farm in Brgy. Lucanin, Mariveles, Baaan.

The study area is characterized as mixture of both secondary forest and grassland area as shown in **Plate 2- 5.**Most of the plants that were observed within the area were Talahib (Saccharum spontaneum), cogon (Imperata cylindrica), Ipil-ipil (Laucaena glauca), and few fruit-bearing trees (i.e. mango, banana, and caimito). It was also observed that the study site served as grazing area for some livestock animals (i.e. cows, carabaos, and goats.

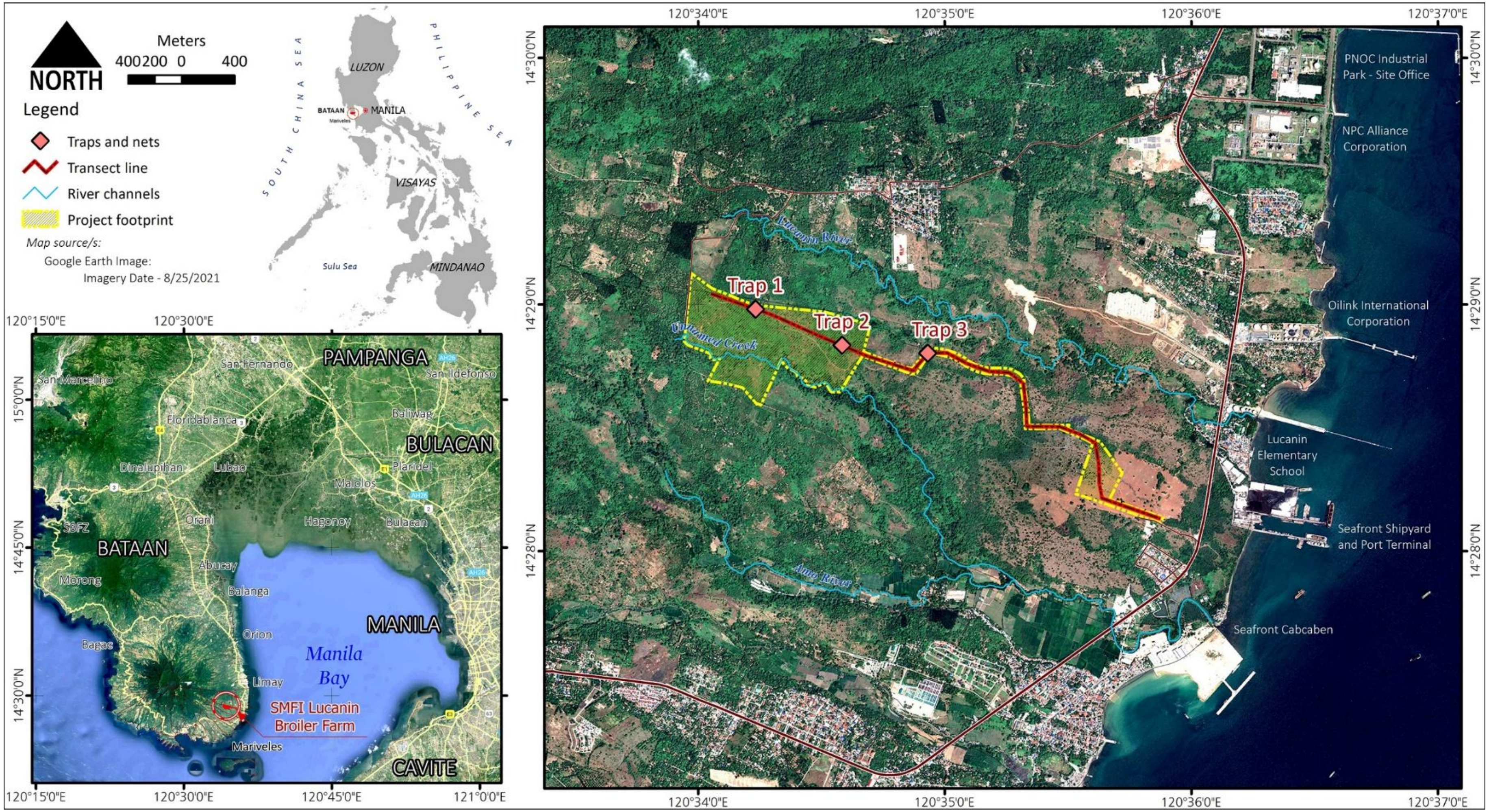

Figure 2-22 Map of the study site for the proposed Multi-Tier Broiler Farm


Plate 2- 5 Existing habitats (secondary forest and grassland) of the study site

2.1.4.2.1 Materials and Methods

The terrestrial fauna survey will focus on the terrestrial vertebrate groups of Philippine wildlife: birds, mammals, amphibians, and reptiles (herpetofauna). Various standard field methods and procedures will be used for each taxon during the survey. The methods and sampling techniques that will be used for each taxon are presented below.

Birds Survey

Bird survey was conducted using mist-netting and line transect survey methods. For the mist-netting technique, three (3) standard 3x6 meters mist net were strategically employed within the site. Mist nets were hoisted along possible flight paths of birds, e.g., in between trees, just above the ground with clearance of at least 15 cm to 1 meters. The nets were set in the afternoon at 3:00 and checked every hour after being hoisted until 5:00 in the afternoon or an hour before dusk, and for four (4) hours from 6:00 – 10:00 in the morning of the next day. These nets were also used to catch volant mammals during the night.

For the line transect survey, a 3-km transect line along the existing trail was used for the direct observations of birds. The pace of walking was varied in order to detect different species. Where possible, observers walked across different habitat types and spent time searching in habitat breaks. Searches were conducted from 5:30 - 8:00 in the morning, and in the afternoon at 3:30-6:00 or before the sun sets. The observer was equipped with binoculars and camera. Birds flying and perched in trees and electric lines will be counted individually.

Birds were identified using the Field Guide to Philippine Birds (Kennedy, Gonzales, Dickinson, Miranda and Fisher, 2000; Allen 2020).

Mammals Survey

Mist nets that were used for birds were also employed for catching bats. Net watching for insectivores was done at 6:00 - 8:00 in the evening. Number of individuals present will be counted or estimated. Photographs of captured individuals were taken.

Live traps were used to catch small non-volant mammals. Roasted coconut meat mixed with peanut butter or fried dried fish were used as bait for live traps. The traps were placed along possible runways, near holes or among root tangles and fallen logs, where small non-volant mammals might be present. Checking of traps was done early in the morning of the next day.

Identification, nomenclature, classification and conservation status will be determined based on Heaney et al (2016) and Synopsis of Philippine Mammals (https://www.fieldmuseum.org/synopsis-philippine-mammals).

Herps (Reptiles and Amphibians) Survey

Observation of reptiles and amphibians was done through Visual Encounter Survey while walking along the transect. In as much as there were no streams or rivers in the survey sites, herping was done after net-watching by examining tree trunks, searching burrows digging under leaf litter in the hope of finding frogs, toad, lizards and snakes.

Identification, nomenclature, classification and conservation status were determined based on Diesmos et al (2008), Diesmos et al (2015), and Auliya & Koch (2020).

Other Methods

Ethno-biological interview with the personnel working inside the project site was conducted to determine the presence of other terrestrial wildlife animals that were not captured and recorded during the field survey. Information such as local names, habitat type, and socio-economic importance were noted. Lastly, activities that may result to loss of wildlife animals were also recorded.

Statistical Analysis

Biodiversity indices (Shannon-Weiner Diversity Index, Dominance Index, and Evenness Index) were computed to determine the diversity of vertebrate wildlife animals within the project site using the formulas below. The computed Shannon-Weiner Diversity Index values were compared and interpreted with the Fernando Biodiversity Scaling System (1998).

Equation 1:

$$H = -\sum_{j=1}^{S} p_i \ln p_i$$

Where:

Pi – fraction of the entire population made up of species *i*

S – numbers of species encountered

RELATIVE VALUES	SHANNON-WEINER INDEX (H')
Very High	3.5-4.0
High	3.0-3.49
Moderate	2.5-2.99
Low	2.0-2.49
Very Low	1.0-1.99

Evenness Index:

Equation 2:

$$E = \frac{H}{\ln(S)}$$

H – Diversity Index

S – Species Richness

RELATIVE VALUES	EVENNESS INDEX
Depressed Community	$0 < E \leq 0.5$
Unstable Community	$0.5 < E \leq 0.75$
Stable Community	$0.75 < E \leq 1$

Dominance Index:

Equation 3:

$$C = \sum_{i=1}^{s} Pi^2$$

S – Species Richness

Pi= The proportion of individuals

Population Trend and Conservation Status

Both population trend and conservation status of all four wildlife groups that were observed in the sampling area were assessed following the International Union for Conservation of Nature's Red List of Threatened Species (IUCN Red List) Categories and Criteria which is being used for the last decade to assess the increasing number of various species in a wide variety of habitats (IUCN 2022). There are nine (9) categories namely: (1) Not Evaluated, (2) Data Deficient, (3) Least Concern, (4) Near Threatened, (5) Vulnerable, (6) Endangered, (7) Critically Endangered, (8) Extinct in the Wild, and (9) Extinct. Definitions of these categories are the following:

IUCN Red List Categories (IUCN 2012):

1. Not Evaluated (NE) - A taxon is Not Evaluated when it has not yet been evaluated against the criteria;
2. Data Deficient (DD) - A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status;
3. Least Concern (LC) - A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category;
4. Near Threatened (NT) - A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future;
5. Vulnerable (VU) – A taxon is vulnerable when it is threatened with extinction unless the circumstances that are threatening its survival and reproduction improve;
6. Endangered (EN) – A taxon is threatened by extinction;
7. Critically Endangered (CR) – A taxon that faces extreme high risk of extinction in the wild;
8. Extinction in the Wild (EW) - A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range; lastly
9. Extinct (EX) - A taxon is Extinct when there is no reasonable doubt that the last individual has died.

Relative Values	Dominance Index
Low Dominance	0 < C < 0.5
Moderate Dominance	0.5 < C ≤ 0.75
High Dominance	0.75 < C ≤ 1.0

2.1.4.2.2 Results and Discussion

Overall, there were 34 wildlife species that were recorded during the survey as shown in **Figure 2-23**. It comprises 26 bird species, 4 mammal species, 3 reptile species and 1 amphibian species. The sampling period coincided with the migratory season of birds. The observed weather conditions of the survey varied from sunny to overcast.

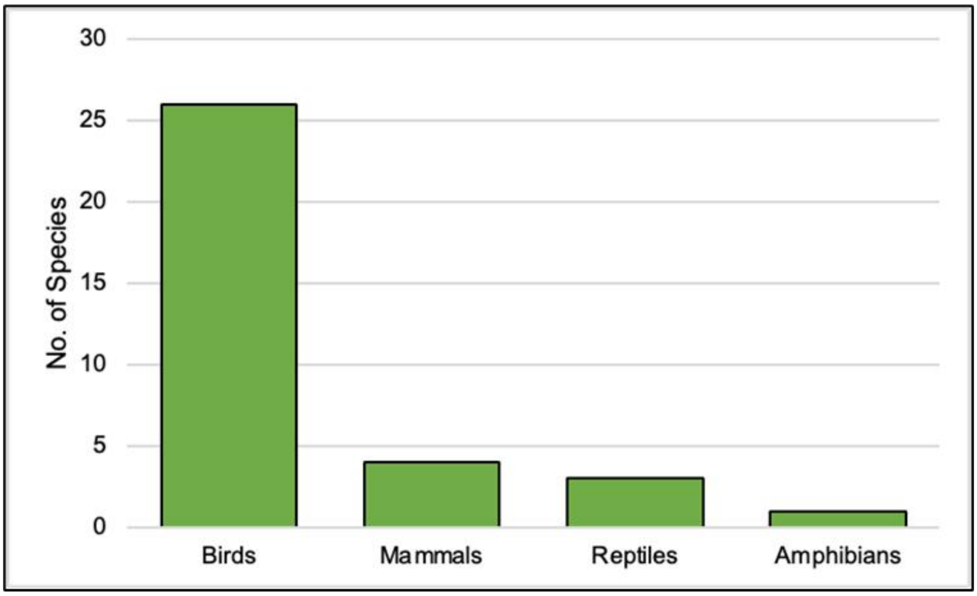

Figure 2-23 Total distribution of wildlife animals that were observed within the proposed broiler farm in Lucanin, Mariveles, Bataan

Avifauna Community

There were 26 bird species that were recorded in the sampling area belonging to 20 bird families in which five bird groups dominate the area namely Columbidae (12%) (doves and pigeons), Cuculidae (8%) (cuckoos), Estrildidae (8%) (munias), Laniidae (8%) (shrikes) and Pycnonotidae (8%) (bulbuls) as shown in **Figure 2-24**. **Table 2-15** shows the list of bird species that were observed in the study area. Based on the computed Shannon-Wiener Diversity Index, the sampling area has relatively high bird diversity with H = 3.118. This high diversity index value can be associated with equally abundant bird species in the area. Apart from the diversity index, computed dominance and evenness indices showed that the area has low bird dominance (Dominance = 0.050) but with relatively high stable community (Evenness = 0.957).

Table 2-15 List of recorded bird species within the project site

COMMON NAME	SPECIES NAME	n	N	P_i	P_i^2	$\ln(P_i)$	$P_i * \ln(P_i)$
Long-tailed Shrike	*Lanius schach*	4	98	0.041	0.002	-3.199	-0.131
Striated Grassbird	*Megalurus palustris*	3	98	0.031	0.001	-3.486	-0.107
Yellow-vented Bulbul	*Pycnonotus goiavier*	5	98	0.051	0.003	-2.976	-0.152
Zebra Dove	*Geopelia striata*	4	98	0.041	0.002	-3.199	-0.131
Glossy Swiftet	*Collocalia marginata*	5	98	0.051	0.003	-2.976	-0.152
Scaly-breasted munia	*Lonchura punctulata*	10	98	0.102	0.010	-2.282	-0.233
Large-billed Crow	*Corvus macrorhynchos*	5	98	0.051	0.003	-2.976	-0.152
Brown Shrike	*Lanius cristatus*	2	98	0.020	0.000	-3.892	-0.079
Barn Swallow	*Hirundo rustica*	4	98	0.041	0.002	-3.199	-0.131
Cattle Egret	*Bubulcus ibis*	6	98	0.061	0.004	-2.793	-0.171
Chestnut Munia	*Lonchura atricapilla*	8	98	0.082	0.007	-2.506	-0.205
Paddyfield Pipit	*Anthus rufulus*	3	98	0.031	0.001	-3.486	-0.107
Pied Bushchat	*Saxicola caprata*	5	98	0.051	0.003	-2.976	-0.152
Brahminy Kite	*Haliastur indus*	1	98	0.010	0.000	-4.585	-0.047
Philippine Bulbul	*Hypsipetes philippinus*	4	98	0.041	0.002	-3.199	-0.131
Olive-backed Sunbird	*Cinnyris jugularis*	4	98	0.041	0.002	-3.199	-0.131
Black-naped Oriole	*Oriolus chinensis*	2	98	0.020	0.000	-3.892	-0.079
Long-tailed Bee-eater	*Merops philippinus*	4	98	0.041	0.002	-3.199	-0.131
Lesser Coucal	*Centropus bengalensis*	2	98	0.020	0.000	-3.892	-0.079
Coppersmith Barbet	*Psilopogon*	4	98	0.041	0.002	-3.199	-0.131
White-breasted Waterhen	*Amaurornis phoenicurus*	4	98	0.041	0.002	-3.199	-0.131
Rough-crested Malkoha	*Dasylophus superciliosus*	1	98	0.010	0.000	-4.585	-0.047
Pied Triller	*Lalage nigra*	2	98	0.020	0.000	-3.892	-0.079
Columba livia	*Columba livia*	3	98	0.031	0.001	-3.486	-0.107
Philippine Cuckoo-Dove	*Macropygia tenuirostris*	1	98	0.010	0.000	-4.585	-0.047
Guaiabero	*Bolbopsittacus lunulatus*	2	98	0.020	0.000	-3.892	-0.079
Shannon-Wiener Index (H) = 3.118							
Evenness Index = 0.050							
Dominance Index = 0.957							

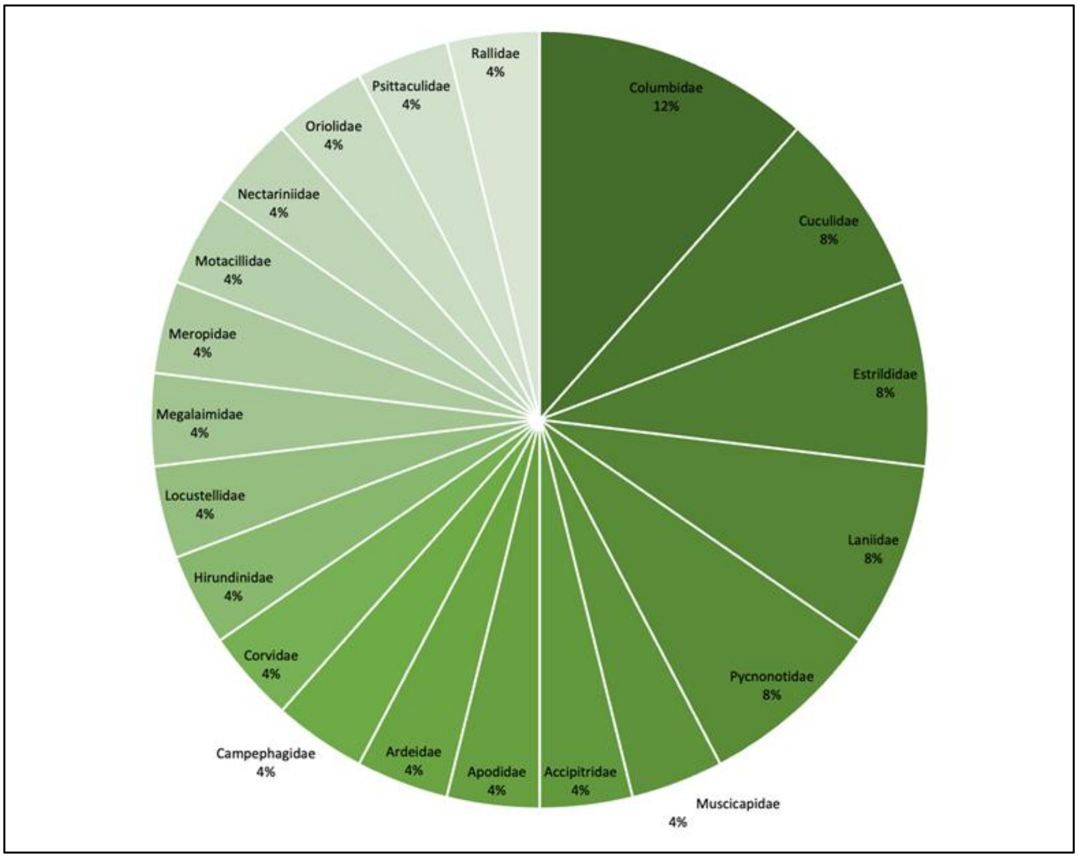

Figure 2- 24 Distribution of bird families within the sampling area

The diversity of birds can also be associated with the habitat association and feeding habitat of birds in the area. Based on the data as shown in **Figure 2- 25**, 13 species area associated with the open country and grassland habitats comprising 50% of all bird species, 12 species are associated with forested habitats comprising 46% of the population, and only one bird species (White-breasted Waterhen Amaurornis phoenicurus) was observed to be associated with swamps and marshes habitats. Furthermore, majority of the recorded birds were insectivores comprising 50% of the total population then followed by the omnivores (23%), frugivores (11%), graminivores (7%), and carnivores and nectarivores with 3% as shown in **Figure 2- 26**.

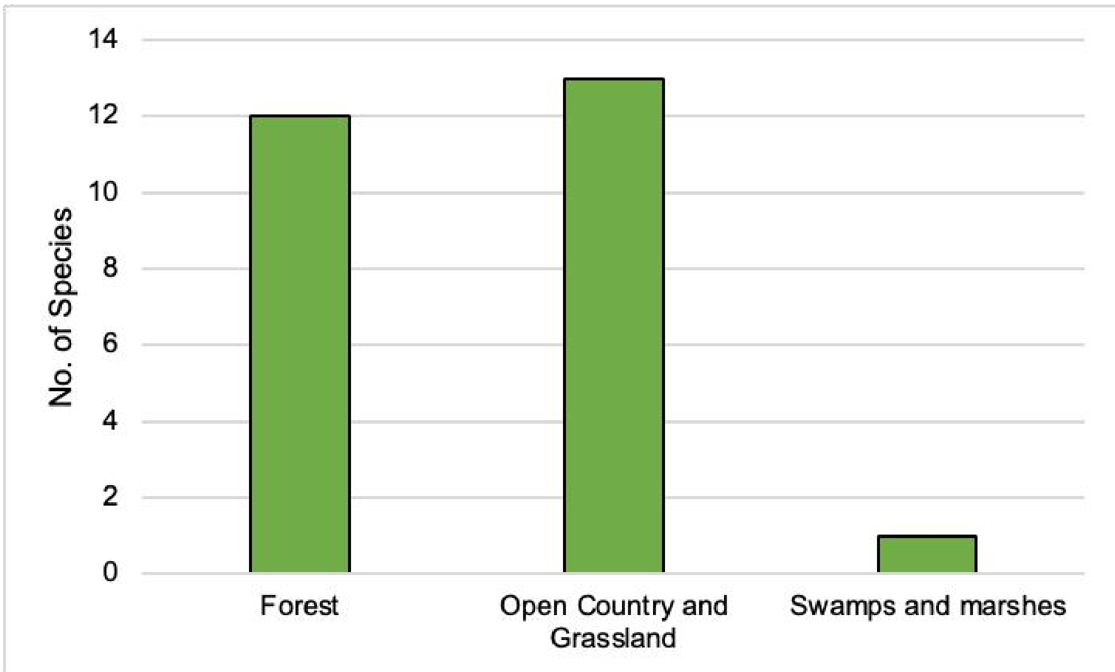

Figure 2- 25 Distribution of bird species based on their habitat association

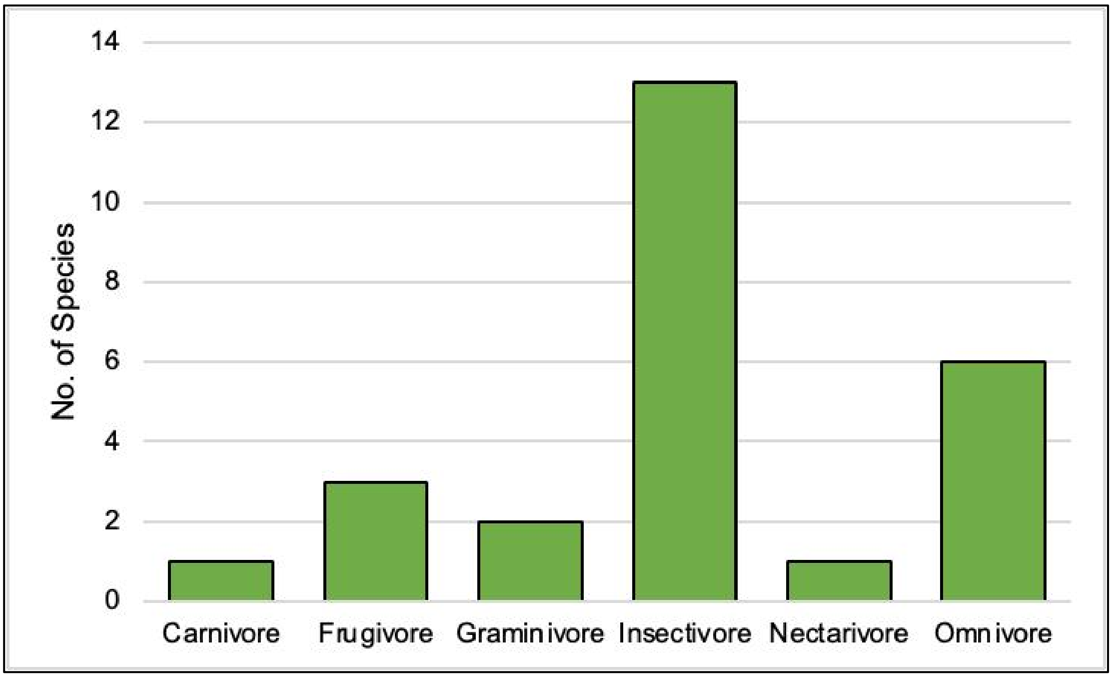

Figure 2- 26 Distribution of bird species based on their feeding habits

Habitat heterogeneity is one of the many factors that contribute to bird diversity. Different habitats provide different types of resources such as food, shelter, and breeding sites that influence the distribution and abundance of bird species. The sampling area is a mixture of secondary forest and grassland with agriculture areas adjacent to the study site. Forested areas may provide shelter for their nesting during their breeding season, and protection against predators (reference). Grassland and other open areas may provide variety of seeds and wildflowers for grassland dependent birds such as the shrikes, munias, and grassbirds (reference).

All recorded bird species have least concern conservation status based on the IUCN Red List (2023). In terms of their regional distribution, there were three (3) identified types of bird distribution namely endemic, migrant, and resident birds as shown in **Figure 2-27**. Majority of these birds are resident in the country (85%), followed by the endemics (11%), and migrant (4%). The three endemic species were the Philippine Bulbul (*Hypsipetes philippinus*), Rough-crested Malkoha (*Dasylophus superciliosus*), and Guaiabero (*Bolbopsittacus lunulatus*). One migrant species (Brown Shrike *Lanius cristatus*) was also observed in the area in which its presence coincides with its breeding season (reference).

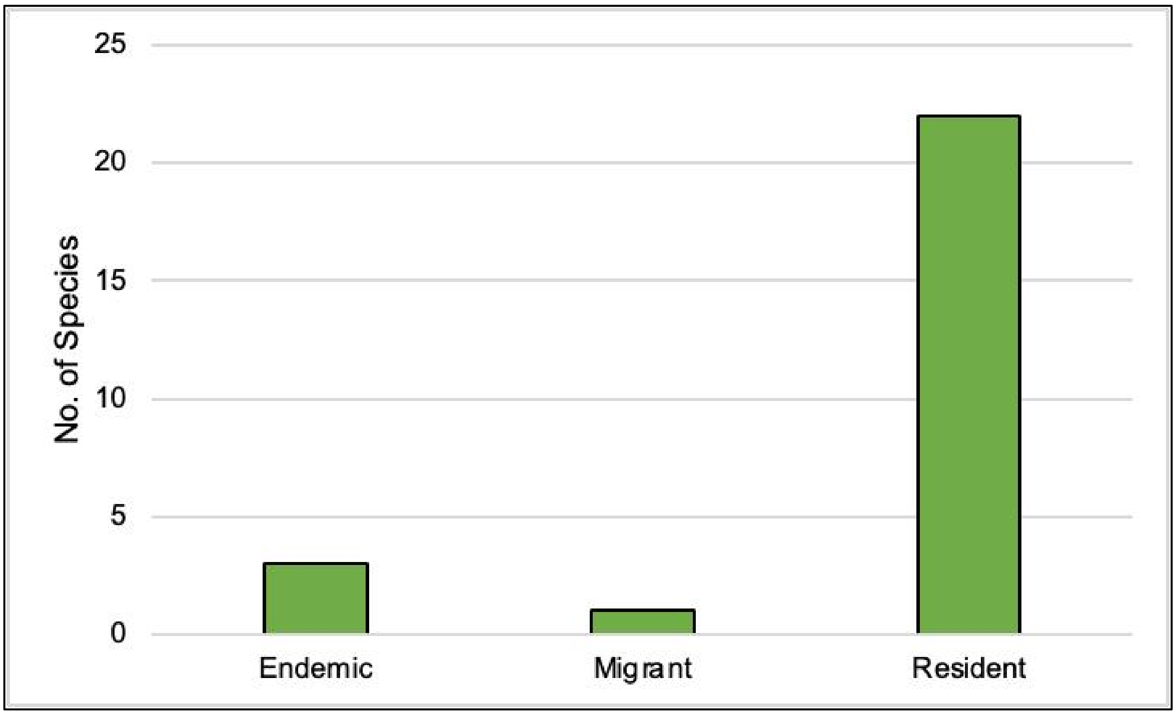

Figure 2-27 Regional distribution of bird species in the sampling area

Majority of the bird species have stable population trend comprising 50% of the population followed by birds with decreasing population (27%) as shown in **Figure 2-28. Table 2-16** shows the list of all recorded bird species with their corresponding population trend and the existing threats to their populations.

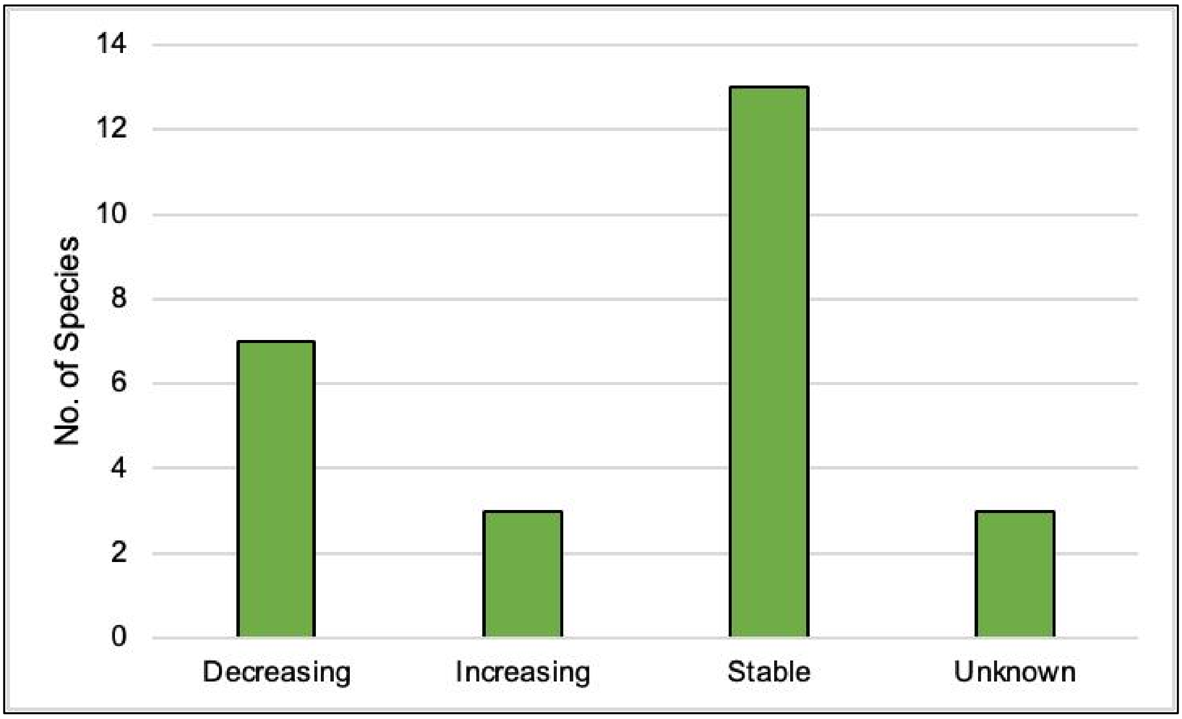

Figure 2-28 Population trend of bird species within the project site.

Table 2-16 Population trend of the recorded bird species

SPECIES NAME	POPULATION TREND	JUSTIFICATION
Lanius schach	Unknown	The trend direction for this population is difficult to determine owing to evidence of both regional increases and decreases, perhaps caused by climatic changes and habitat destruction
Megalurus palustris	Unknown	The trend direction for this population is difficult to determine owing to evidence of both regional increases and decreases, perhaps caused by climatic changes and habitat destruction
Pycnonotus goiavier	Increasing	The population is suspected to be increasing rapidly as this species benefits from deforestation and the creation of artificial habitats
Geopelia striata	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Collocalia marginata	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Lonchura punctulata	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Corvus macrorhynchos	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Lanius cristatus	Decreasing	This population is estimated to be declining following a decline of 80% in Japan between the 1970s and 1990s

Species Name	Population Trend	Justification
Hirundo rustica	Decreasing	The global population is tentatively assessed as being in decline.
Bubulcus ibis	Increasing	The overall population trend is increasing, although some populations may be stable, decreasing or have unknown trends
Lonchura atricapilla	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Anthus rufulus	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Saxicola caprata	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Haliastur indus	Decreasing	The population is declining, especially in South-East Asia, owing to loss of habitat, persecution, over-use of pesticides and, possibly, increased human hygiene resulting in reduction of available scraps
Hypsipetes philippinus	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Cinnyris jugularis	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Oriolus chinensis	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Merops philippinus	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Centropus bengalensis	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.
Psilopogon haemacephalus	Increasing	This adaptable species shows a preference for man-made and altered habitats, it is common throughout its range and is found in heavily urbanized areas
Amaurornis phoenicurus	Unknown	The trend direction for this population is difficult to determine owing to evidence of both regional increases and decreases, perhaps caused by climatic changes and habitat destruction
Dasylophus superciliosus	Decreasing	The population is suspected to be in decline owing to ongoing habitat destruction.
Lalage nigra	Decreasing	The species is tentatively assessed as being in decline due to habitat loss and high hunting pressure.
Columba livia	Decreasing	The population size is suspected to be decreasing owing to interbreeding with domestic form
Macropygia tenuirostris	Decreasing	The population size of this species is precautionarily suspected of declining due to ongoing forest loss in its range
Bolbopsittacus lunulatus	Stable	The population is suspected to be stable in the absence of evidence for any declines or substantial threats.

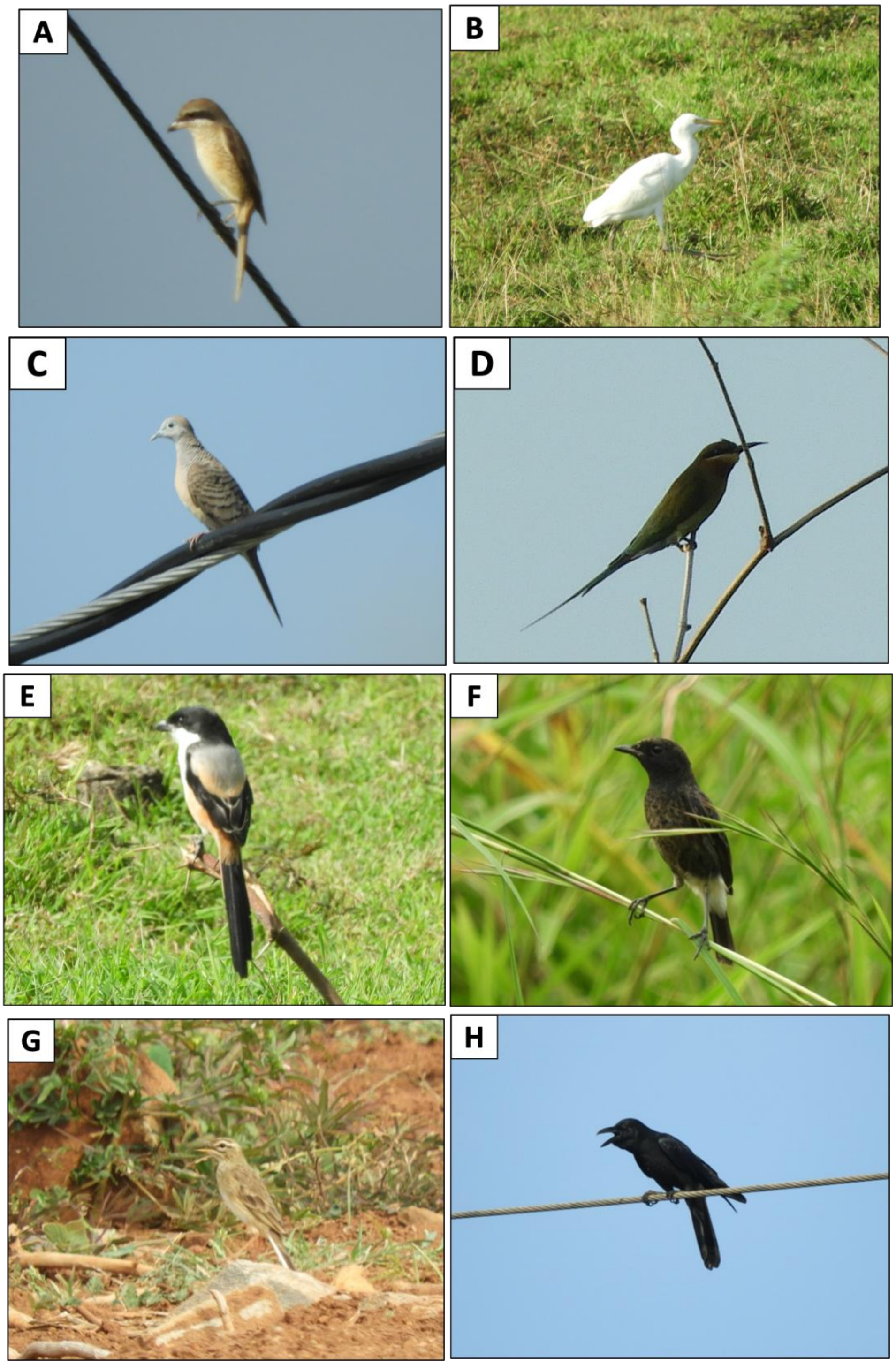

Plate 2-6 Photos of the selected bird species that were observed within the project site. (A) *Lanius cristatus*, (B) *Bubulcus ibis*, (C) *Geopelia striata*, (D), *Merops philipinus*, (E) *Lanius schach*, (F) *Saxicola caprata*, (G) *Anthus rufulus*, and (H) *Corvus macrorhynchus*.

Mammal Community

There were only four species of mammals that were recorded in the area as shown in **Table 2-17** and **Plate 2-7** in which two species are fruit bats, one species of nectar-feeding bat, and one rodent species. Based on the computed diversity indices, the sampling area has very low mammal diversity, low dominance index but with relatively stable community based on evenness index. The high evenness and low diversity/dominance values for mammals may indicate that there are few species that were recorded during the survey. All mammal species have least concerned conservation status (IUCN Red List 2023) and all four species are resident in the country.

The Lesser Short-nosed Fruit Bat (Cynopterus brachyotis) is common in Southeast Asian countries including the Philippines. It typically inhabits forests, both primary and secondary, as well as urban areas, where it roosts in trees or buildings. This species primarily feeds on ripe fruits and nectar, and is an important pollinator and seed disperser for many plant species.

The Greater Musky Fruit Bat (Ptenochirus jagori) is also common in the Philippines. This bat species has distinctive tubular nostrils, which it uses to locate and feed on flowers and fruits. It is primarily nocturnal and roosts during the day in small groups in trees or caves.

The Geoffroy's Rousette (Rousettus amplexicaudatus) typically inhabits forests, savannas, and other wooded areas, where it roosts in caves or trees. It is a frugivorous bat that feeds primarily on fruits, but may also consume flowers, nectar, and pollen. It is an important pollinator and seed disperser for many plant species in its range.

Lastly, the Asian House Rat (Rattus tanezumi) is widely distributed in Southeast Asian countries. This species is considered as pest for its ability to adapt to a wide range of habitats and environments, including urban areas, agricultural fields, and natural habitats such as forests and grasslands. In addition, it is known to be a vector for several diseases, including leptospirosis, salmonellosis, and rat-bite fever. It can also cause damage to crops and infrastructure, as well as compete with native wildlife for resources.

Table 2-17 List of Mammal species that were observed within the project site

COMMON NAME	SPECIES NAME	n	N	P_i	P_i^2	$\ln(P_i)$	$P_i * \ln(P_i)$
Asian house rat	*Rattus tanezumi*	3	21	0.143	0.020408	-1.946	-0.278
Lesser short-nosed fruit bat	*Cynopterus brachyotis*	8	21	0.381	0.145125	-0.965	-0.368
Greater musky fruit bat	*Ptenochirus jagori*	5	21	0.238	0.056689	-1.435	-0.342
Geoffroy's rousette	*Rousettus amplexicaudatus*	5	21	0.238	0.056689	-1.435	-0.342
Shannon-Wiener Index (H) = 1.329							
Evenness Index = 0.959							
Dominance Index = 0.279							

Table 2-18 Population trend of the recorded mammal species within the project site

SPECIES NAME	POPULATION TREND	JUSTIFICATION
Rattus tanezumi	Increasing	It is a common to abundant species.
Cynopterus brachyotis	Unknown	In Southeast Asia, it is generally locally abundant and most common in disturbed and residential areas
Ptenochirus jagori	Stable	Although this is a widespread and abundant species with large populations, it has likely experienced low-level population declines due to forest loss
Rousettus amplexicaudatus	Unknown	It is thought to be declining due to extensive disturbance in its roosts from hunting, mining and other threats however, this is a widespread species that is commonly encountered.

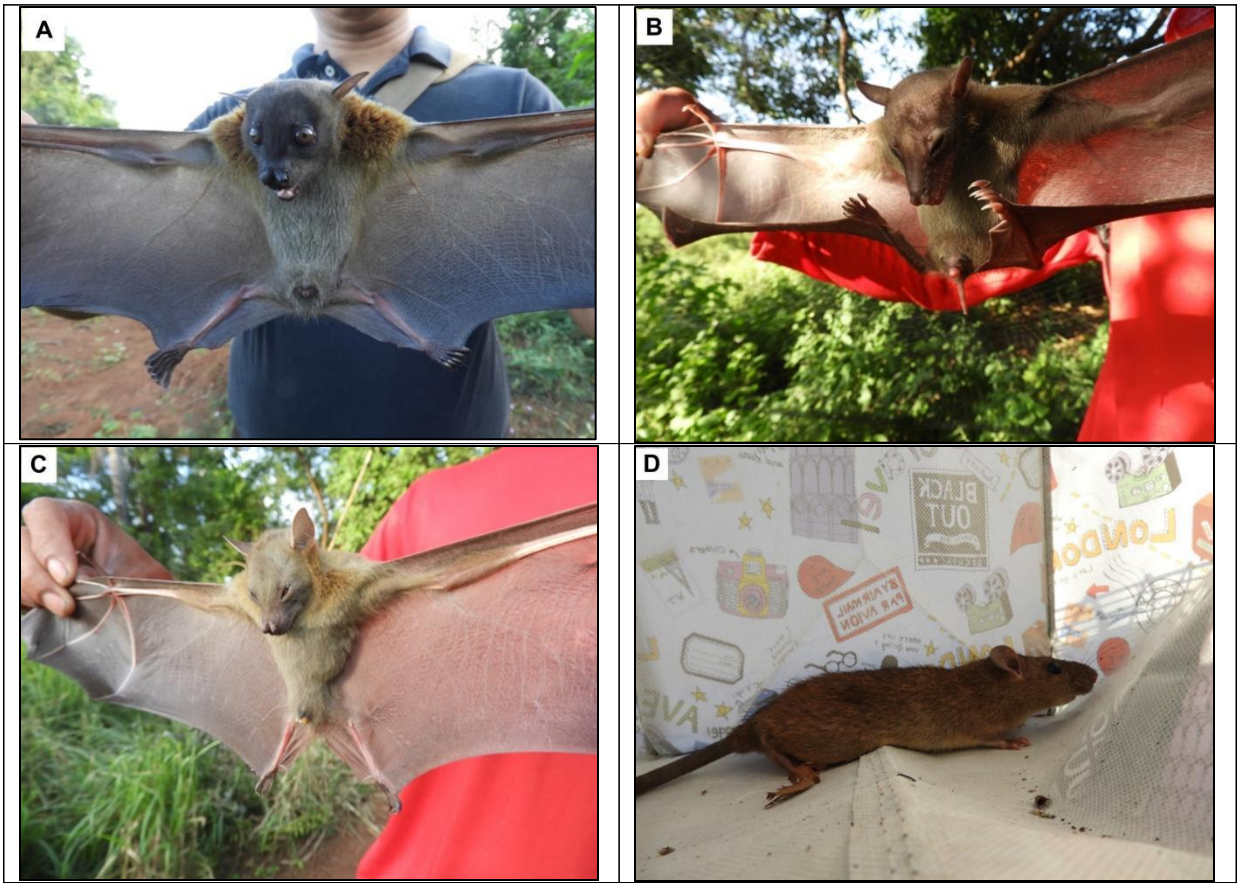

Plate 2-7 Photos of the four mammal species that were observed within the project site. (A) *Ptenochirus jagori*, (B) *Rousettus amplexicaudatus*, (C) *Cynopterus brachyotis*, and (D) *Rattus tanezumi*.

Amphibians and Reptiles Community

A total of four herp species that were recorded in the study area comprising one species of amphibian and three species of reptiles. Based on the computed diversity indices, the area has low herps diversity (H = 1.321) and low dominance index (0.281) but with high evenness index (0.953) as shown in Table X. Similar with the mammal group, the high evenness and low diversity/dominance of herps may indicate that there were few species that were recorded during the survey. All species have least concern conservation status (IUCN Red List 2023) and all four species are resident in the country.

The Tockay Gecko (Gekko gecko) is common in Asian countries and it is primarily arboreal, and can be found in a variety of habitats, including forests, plantations, and human settlements. It feeds on a variety of prey, including insects, spiders, and small vertebrates, and is known to be an effective predator. Even though it is least concerned species, it is often collected and traded in the pet trade and may be threatened by habitat loss and fragmentation due to deforestation and human activities.

The Reticulated python (Malayopython reticulatus) is also common in the Philippines, and it is highly adaptable to various habitats (rainforests, grasslands, and even human settlements). This reptile is often targeted by the hunters for its skin for fashion industry and serves as Chinese medicine. The presence of this species was based on the local interview.

The East Indian Brown Mabuya (Eutropis multifsciata) is common in all areas in the Philippines. It is a diurnal species and is commonly found in a variety of habitats, including forests, grasslands, and human settlements. This species is an insectivore, and feeds on a variety of insects and other invertebrates, such as ants, termites, and beetles. It is an important predator in its ecosystem and helps to control insect populations.

Lastly, the Cane Toad (Rhinella marina) is a highly adaptable amphibian inhabiting in various types of habitats and currently considered as invasive species. Due to its toxic skin secretions that can cause seizures, paralysis, and death in animals, there is no known predator for this species.

Table 2- 19 List of reptiles and amphibian that were observed within the project site

COMMON NAME	SPECIES NAME	n	N	P_i	P_i^2	$ln(P_i)$	$P_i * ln(P_i)$
Tockay Gecko	*Gekko gecko*	2	8	0.25	0.250	-1.386	-0.347
Reticulated Python	*Malayopython reticulatus*	1	8	0.125	0.125	-2.079	-0.260
Cane Toad	*Rhinella marina*	3	8	0.375	0.375	-0.981	-0.368
East Indian Brown Mabuya	*Eutropis multifasciata*	2	8	0.25	0.250	-1.386	-0.347
Shannon-Wiener Index (H) = 1.321							
Evenness Index = 0.953							
Dominance Index = 0.281							

Table 2-20 Population trend of the recorded amphibian and reptile species

SPECIES NAME	POPULATION TREND	JUSTIFICATION
Gekko gecko	Unknown	Global population trends are unknown; while disturbance is increasing the availability of suitable habitat, the species is also subject to increasing harvesting pressure
Malayopython reticulatus	Unknown	This snake's population status, and the availability of population data, greatly vary across the species' large geographic range
Rhinella marina	Increasing	There are no significant threats to this very adaptable, invasive species
Eutropis multifasciata	Stable	There are no major threats to this species

Noteworthy Species in The Study Area

The International Union for Conservation of Nature's Red List is the most comprehensive information source of global extinction risk status of animals, plants, and fungus species (IUCN 2022). Wildlife animals are categorized into nine (9) categories: 1) Not Evaluated, (2) Data Deficient, (3) Least Concern, (4) Near Threatened, (5) Vulnerable, (6) Endangered, (7) Critically Endangered, (8) Extinct in the Wild, and (9) Extinct based on the current status of their populations. On the other hand, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is a multilateral treaty to provides protection of various endangered wildlife animals and plants (Brown and Swails 2005). Wildlife animals are grouped into three categories: Appendix I - are species that are threatened with extinction and are or may be affected by trade; Appendix II - are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild; and Appendix III - are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species. Lastly, the DENR Administrative Order 2019-09 is a list of threatened wildlife species with their corresponding categories in pursuant of the Philippine Republic Act No. 92147 "Wildlife Resources Conservation and Protection Act" (DAO 2019-09).

Based on the conducted fauna survey, all 34 recorded wildlife animals have least concern conservation status and there are only three (3) species that are endemic in the Philippines but not geographically restricted within the project site as shown in **Table 2-21**. There is one species listed under CITES and two species under DAO 2019-09 (**Table 2-22**).

Table 2-21 List of noteworthy wildlife species within the project site

SPECIES NAME	DISTRIBUTION	IUCN	CITES	DAO 2019-09
Hypsipetes philippinus	Endemic	Least Concern	-	-
Dasylophus superciliosus	Endemic	Least Concern	-	-
Bolbopsittacus lunulatus	Endemic	Least Concern	-	-
Gekko gecko	Resident	Least Concern	Appendix II	OTS
Malayopython reticulatus	Resident	Least Concern	-	OTS

Table 2-22 Summary of conservation status of identified wildlife animals in the project site

TAXON	NUMBER OF ENDEMIC SPECIES RECORDED	NUMBER OF SPECIES LISTED AS THREATENED IN IUCN RED LIST 2023	NUMBER OF SPECIES LISTED AS THREATENED IN CITES 2022	NUMBER OF SPECIES LISTED AS THREATENED IN DAO 2019-09
Birds	3	0	0	0
Mammals	0	0	0	0
Amphibians	0	0	0	0
Reptiles	0	0	1	2

2.1.4.3 Identified Threats of the Project to Wildlife Animals

The proposed broiler farm in Lucanin, Mariveles, Bataan includes the construction of various buildings and roads and these activities involve excavation of existing soils, clearing of vegetation, accumulation of dust particles, soil erosion, and possible generation of solid and liquid wastes from the equipment and working personnel. These activities may threaten the existing population of wildlife animals within the project site. These enumerated activities are specifically discussed Table 9 with corresponding mitigating measures. In summary, all the identified wildlife animals in the proposed project site have Least Concerned status based on the IUCN Red List (2023) and only two wildlife species have threatened population status according to DAO 2019-09, but these species are not restricted within the project site and in the country. Given threatened status, strict implementation of conservation measures by the project management is highly recommended to protect these species from possible hunting and poaching, and other threats during the construction and operation stages.

2.1.4.4 Identification of Impacts per Project Phase (Based on the Project Component)

The potential ecological impacts of the proposed broiler farm project shall be assessed in all phases of development in terms of time/duration and geographic area affected. The construction activities might create potential impacts on land, water, air and people.(**Table 2-23**).

Table 2-23 Impacts per Project Phase

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT	NATURE	MAGNITUDE	DURATION

ENVIRONMENTAL ASPECT	ENVIRONMENTAL IMPACT	NATURE	MAGNITUDE	DURATION
PRE-CONSTRUCTION				
LAND	Soil erosion and change in land use due to site clearing and excavation	-	Moderate	Short
	Displacement of vegetation due to land excavation	-	Low	Short
WATER	N.A.	N.A.	N.A.	N.A.
AIR	Increase in air and noise pollution	-	Low	Short
PEOPLE	Presence of workers	-	Low	Short
CONSTRUCTION				
LAND	Removal of vegetation by cutting of nearby trees	-	Moderate	Short
	Generation of fuel spills from vehicle and excavating equipment	-	Low	Short
	Displacement of wildlife	-	Low	Short
WATER	N.A.	N.A.	N.A.	N.A.
AIR	Increased concentration of fumes generated by the vehicles and equipment in the project sites	-	Low	Medium
	Dust accumulation	-	Low	Medium
	Increase in noise level	-	Low	Medium
PEOPLE	Presence of workers	-	Moderate	Medium
OPERATION				
LAND	Accumulation of fecal materials	-	High	Long
	Increase of human waste materials	-	Moderate	Long
AIR	Odor produced from the poultry farm	-	High	Long
WATER	Possible fecal contamination of nearby river	-	High	Medium
PEOPLE	Increased no. of people due to employment opportunity	+	Low	Medium
	Increase in local population	+/-	Low	Medium

Note: - means negative; + mean positive; Short (0-6 months); Medium (7 months-3 years); Long (>3 years)

Pre- and Construction Phases

Clearing of vegetation in the project site may lead to wildlife animal displacement and it also removes their existing habitats. Several fruit- and flower-bearing plants were observed during the survey which serve as food sources for wildlife such as for Lesser Short-nosed fruit bat, Greater Musky fruit bat, Long-tongued Nectar bat, and Geoffroy's Rousette. Clearing of the existing vegetation may also lead to migration of wildlife to other areas not affected by the project activities. Clearing of vegetation may also result to soil erosion most especially in some areas with steep slopes (**Table 2-24**)

Table 2-24 Possible Impact and Mitigating Measures in Clearing and Removal of Existing Vegetations

Activity	Impact	Mitigating Measures
Clearing and Removal of Existing Vegetations	Possible displacement of wildlife animals	Areas to be cleared should be delineated by fences to avoid excessive removal of vegetations. Areas to be cleared of vegetation should be rehabilitated to near pre-project conditions as possible. This would entail reforestation using indigenous plant species.

Noise pollution will be generated during the construction phase of the project from drilling activities, and movements of large excavating equipment and vehicles. If substantial and repetitive noise will be generated, it will force some wildlife animals to be displaced in other areas. Noise pollution may also affect wildlife animals that are sensitive to excessive noise (e.g. bats).

Excavation may include the use of excavating equipment and large vehicles that may generate dust emissions, smoke, and noise in the project site. Dust emission may result to respiratory impairment of wildlife animals and may result to death. These animals include the non-volant mammals such as rodents. **Table 2-25** shows the mitigating measures for the impact during the utilization of large equipment's.

Table 2-25 Possible Impact and Mitigating Measures in Utilization of Large Equipment

Activity	Impact	Mitigating Measures
Utilization of large equipment and vehicles	Generation of noise pollution	• Operation of high noise-emitting equipment and vehicles must be scheduled to prevent unnecessary activities. • Equipment and vehicles must be subjected to regular maintenance to minimize excessive noise
	Excavation of soil using large excavating equipment	• For large vehicles that expire dust and smoke, devise a routing scheme for hauling vehicles to minimize areas to be disturbed and water should be sprinkled to minimize dust accumulation and spreading • Water should be sprinkled near blasted areas to minimize dust accumulation and spreading

It is unavoidable to generate solid and liquid waste materials during the construction phases from the equipment, vehicles, and from the workers. However, these waste materials may post threats to wildlife animals within the area especially for rodents, snakes and monkeys that may scavenge from discarded wastes (**Table 2-26**).

Table 2-26 Possible Impact and Mitigating Measures in Disposing of waste materials and establishment of disposal areas

ACTIVITY	IMPACT	MITIGATING MEASURES
Disposal of waste materials and establishment of disposal areas	Creation of solid and liquid wastes from equipment, vehicles, and personnel workers.	• Equipment and vehicles must be checked regularly to avoid generation of oil waste materials • Disposal areas must be confined on solid ground and not occupy existing vegetations • Waste disposal should be coordinated with the project management to avoid excessive accumulation of wastes

Operation Phase

Generation and accumulation of fecal and other waste materials from the poultry farm is unavoidable. Most of the established poultry farms use fecal matters as manure/fertilizer which provide nutrients for the soil. However, these problems can have severe effect to the nearby wildlife animals. Poultry manure contains mixture of large amounts of nitrogen, phosphorous, potassium, antibiotic residues, heavy metals, and parasites. This can be avoided by construction of septic vault or tank for waste materials.

Table 2-27 Possible Impact and Mitigating Measures during Operation Phase

IMPACT	MITIGATING MEASURES
Accumulation of fecal matter from the poultry farm that can contaminate the nearby habitats such as the river system.	Construct septic vault/tank for waste materials

2.2 WATER

This section discusses the study on the baseline and secondary data on hydrology/hydrogeology, water quality and aquatic ecology. The surface water and ground water quality sampling was carried out on February 9,2023 while the marine water quality sampling was conducted on February 15,2023.

This section also provides assessment of the potential impact of the project to water and corresponding mitigating measures.

2.2.1 Oceanography

2.2.1.1.1 Methodology

This component of the EIA project examined plankton (phytoplankton and zooplankton), soft bottom subtidal infaunal benthos, corals and macrophytes (seagrass and macrobenthic algae/seaweeds), and local fisheries resources to evaluate their present conditions and the prospects for affording meaningful protection.

Plankton

Plankton is a term used to describe collectively small, mostly microscopic organisms, which drift about passively in the water. Plant and animal members of the plankton are considered separately under the terms phytoplankton (photosynthetic microalgae) and zooplankton (animal plankton), respectively.

This study aims to contribute some basic information to the general knowledge on the phytoplankton and zooplankton ecology in the nearshore marine waters of Lucanin. The specific objectives are to determine the species composition, density and relative abundance of phytoplankton and zooplankton in the area. Phytoplankton is a community of microscopic algae that is at the base of the food web. They are an important resource that supports the higher tropic levels of the aquatic ecosystem. Understanding the dynamics and production of phytoplankton may contribute to the elucidation of the status of fishery resources and may be the key for better fisheries management since phytoplankon is at the base of the food chain. Zooplankton, on the other hand, plays a major role in the functioning and the productivity of aquatic ecosystems through its impact on the nutrient dynamics and its key position in the food webs. Likewise, zooplankton community is highly sensitive to environmental change as they respond to disturbances in the environment like nutrient loading and fish densities.

Table 2-28 Sampling data of the four plankton stations in Lucanin (Mariveles, Bataan)

STATION	GPS COORDINATES		DEPTH (m)	APPROX. DISTANCE FROM SHORE (M)	PREVAILING WIND / SEA CONDITION/TIDE	DATE/TIME OF SAMPLING (2023)
	Latitude North	LONGITUDE EAST				
MPL1	14°27'38.30"	120°36'15.80"	3.5	308	NE/Somewhat Rough/High Tide	15 Feb/09:30 a.m.
MPL2	14°28'27.10"	120°36'24.60"	3.5	289	NE/Somewhat Rough/High Tide	15 Feb/12:00.n.n.
MPL3	14°27'47.72"	120°36'23.81"	10.0	458	NE/Rough/High Tide	15 Feb/10:00.a.m.
MPL4	14°28'21.69"	120°36'30.29"	6.0	488	NE/Rough/High Tide	15 Feb/11:30.a.m.

Legend: MPL = Marine Plankton

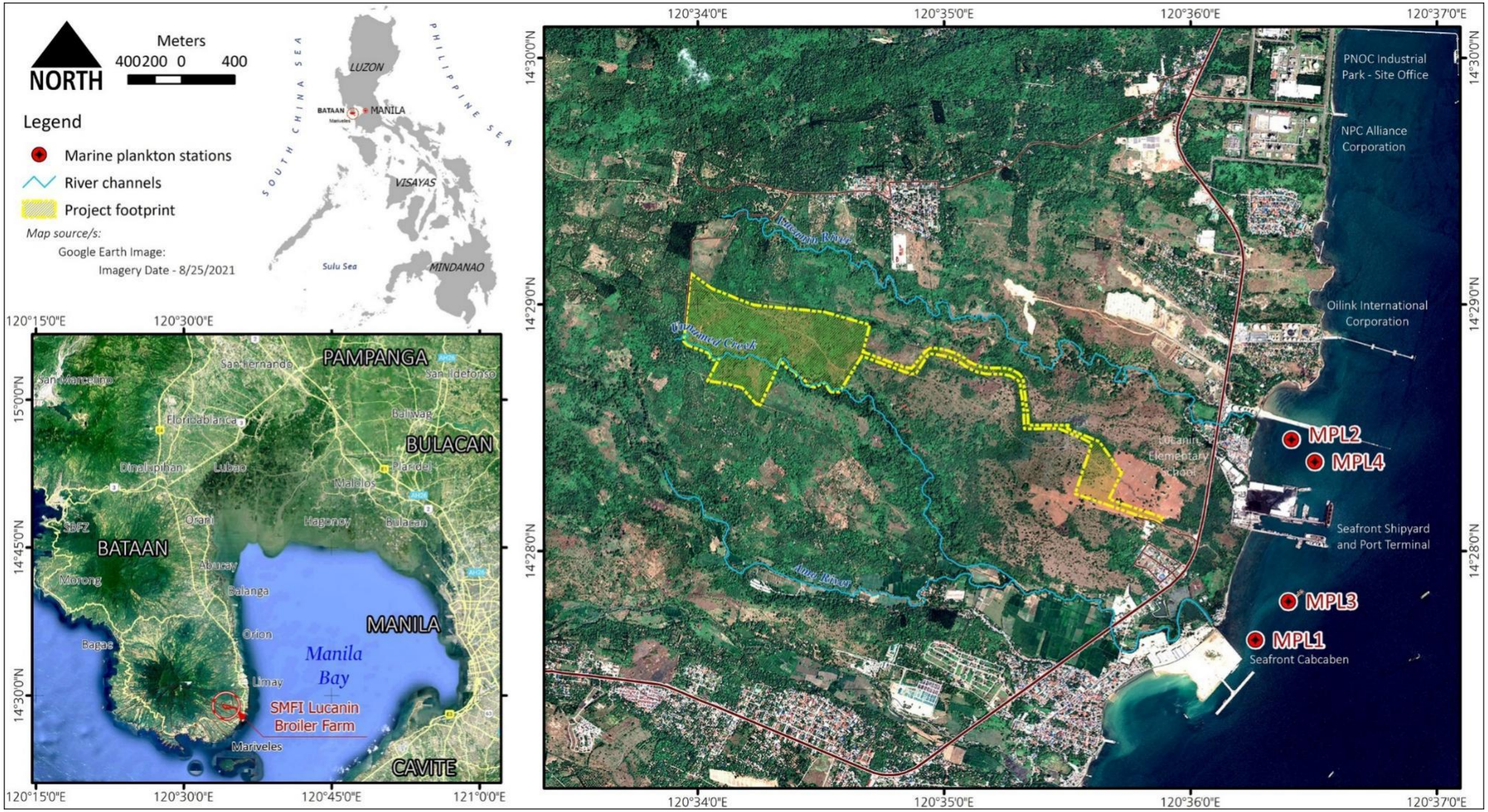

Figure 2- 29 Locations of plankton sampling stations in Lucanin (Mariveles, Bataan)

A medium-sized motorized boat with outrigger was used as sampling/diving platform during the baselining survey. Conventional plankton net was used with stainless circular frame and detachable cod ends (specs. 25 cm mouth diameter, 20 µm mesh size and 1 meter length) (**Plate 2-8**). Duplicate plankton samples were collected by vertical hauling of the net from near the bottom to the surface of each station to minimize the effect of variations brought about by diurnal migration of plankton. In this manner, all levels of the water column were sampled (Estudillo, 1979). A calibrated flowmeter was attached to the center of the mouth of the plankton net to obtain an estimate of the volume of water filtered by the net during each haul. On board, samples were transferred and stored in a 250 ml polyethylene bottle and preserved in 10% formalin. The samples were then brought to the laboratory for analysis at the National Fisheries Research and Development Institute (NFRDI) in Quezon City.

The numerical density of plankton (phytoplankton and zooplankton) organisms was determined using an aliquot. The samples in the aliquot were, at first, examined microscopically to determine the identity of the components represented and were, later, counted for organisms using a Sedgewick-Rafter cell. The densities of phytoplankton and zooplankton organisms were estimated, and then transformed to number of cells or number of organisms per cubic meter of seawater (cells or organisms/m^3). The biomasses of plankton samples were determined for each sample using the "wet" displacement volume method (Ahlstrom, 1976). The plankton volume measurement provides a rough measure of planktonic biomass (Smith and Richardson, 1977), and can be considered as an index to the amount of living matter present in the form of one or more of the various kinds of organisms comprising a plankton population (Beers, 1976). The biomasses of plankton samples were estimated, and then transformed to volume in milliliter per cubic meter (mL/m^3).

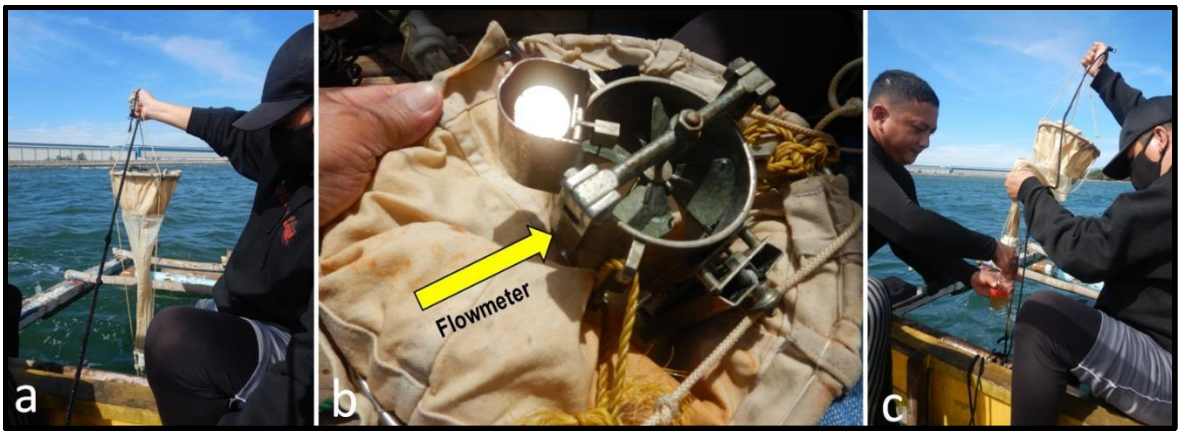

Plate 2-8 (a) Plankton sampling by 25 cm mouth diameter, 20 µm mesh size and 1 meter length plankton net; (b) flowmeter attached to the center of the mouth of the plankton net; and (c) transferring of plankton sample from the plankton bucket into a 250 ml glass bottle container

Soft Bottom Infaunal benthos

Benthic or bottom dwelling animals are classified according to their habits. Those animals that burrow into soft sediments are called infauna and those that are attached to hard substrates or live in or on the bottom substrate form the epifauna. The soft bottom subtidal infaunal benthos communities are one of the least studied biological components. These faunae, which are associated with soft bottom substrate, constitute as one of the most abundant major components of the food habits of many benthic or demersal (bottom dwelling) fishes and edible invertebrates on the sea. The soft bottom benthic communities are diverse and play an important role as support systems for the aquatic environment.

The study aims to evaluate the soft bottom infaunal benthic community along the project site with respect to its composition, density, relative abundance and biomass. The study also aims to contribute some baseline information to the general knowledge of the soft bottom benthos community in the area.

A total of four (4) subtidal benthos stations (MSB) were sampled in this study. The data on coordinates, depth, types of substrate, distance from shore, prevailing wind/tide/sea condition, and date/time of sampling at each sampling station are shown in **Table 2-29 .** The approximate locations of these sampling stations are indicated in **Figure 2-30**Table 2-17**.**

Table 2-29 Sampling data of the four soft bottom subtidal benthos stations in Lucanin (Mariveles, Bataan)

STATION	GPS COORDINATES		DEPTH (m)	TYPE OF SUBSTRATE	APPROX. DISTANCE FROM SHORE (m)	PREVAILING WIND / TIDE/ SEA CONDITION	DATE/TIME OF SAMPLING (2023)
	LATITUDE NORTH	LONGITUDE EAST					
MSB1	14°27'40.40"	120°36'14.00"	2.0	Sandy	114	NE/Somewhat Rough/High Tide	15 Feb/09:30 a.m.
MSB2	14°28'28.33"	120°36'18.99"	1.0	Sandy	171	NE/Somewhat Rough/High Tide	15 Feb/12:00 n.n.
MSB3	14°27'47.72"	120°36'23.81"	10.0	Muddy	463	NE/Rough/ High Tide	15 Feb/10:10 a.m.
MSB4	14°28'21.69"	120°36'30.29"	6.0	Muddy	490	NE/Rough/ High Tide	15 Feb/11:30 a.m.

Legend: MSB = Marine Subtidal Benthos

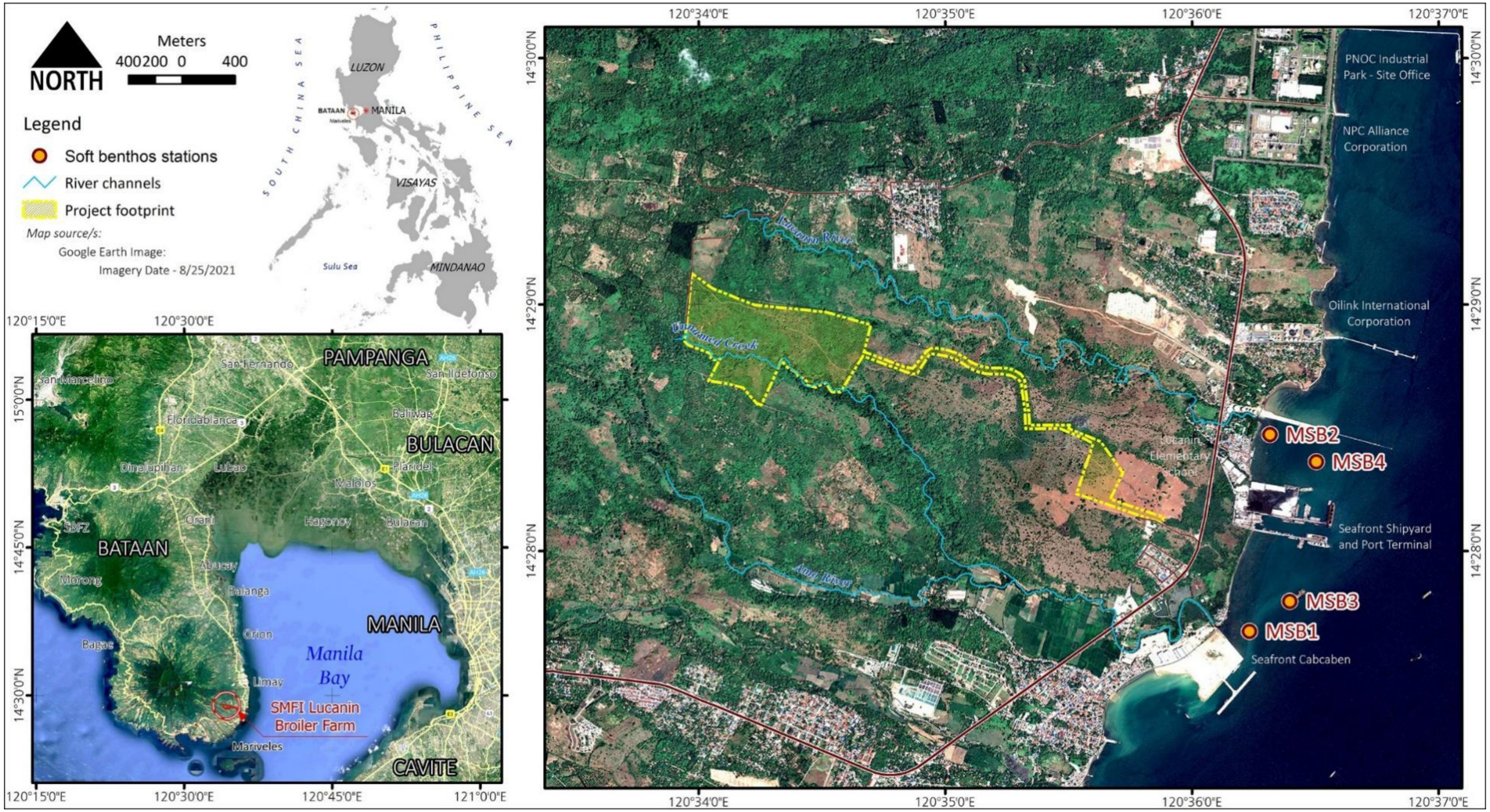

Figure 2- 30 Locations of soft bottom infaunal benthos sampling stations in Lucanin (Mariveles, Bataan)

Sediment samples for infaunal soft bottom benthos study were collected using an Ekman bottom grab sampler with an area of 0.0225 m^2 (**Plate 2-9**). Duplicate samples were obtained from each station and sieved through a 0.5 mm wire mesh sieve immediately after the collection. The sediment residues with the organisms retained in the sieve were placed in a plastic container, stained with Rose Bengal and preserved in 10% formalin. Samples were processed in the laboratory of the Zoology Department of the National Museum in Manila where they were washed with tap water to get rid of excess formalin. Sorting of organisms from the sediments was done with the aid of a stereo zoom microscope (**Plate 2-10**). Identified organisms were placed in vials containing 70% alcohol and classified to family level, if possible. Specimens sorted from the sediment samples were counted to analyze their density. Density was expressed in terms of individuals per square meter (indv/m^2). An index of diversity of benthic organisms (within major taxonomic group) using Shannon-Weaver Index was computed for the communities found in different stations. Biomass of the benthic fauna for each sampling site was also measured and expressed in wet weight in grams per square meter (wwt g/m^2).

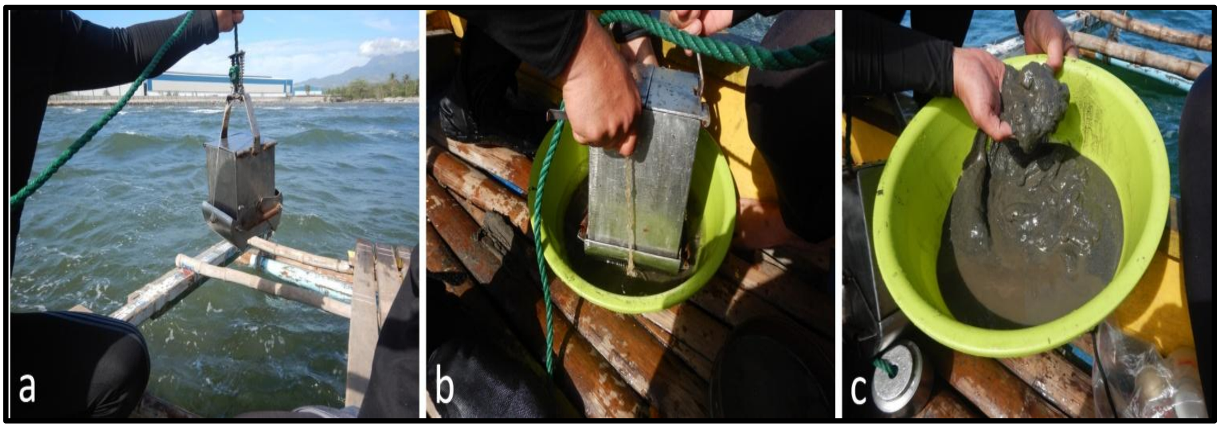

Plate 2-9 Sediment sampling for soft bottom subtidal infaunal benthos analysis using using an Ekman bottom grab sampler with an area of 0.0225 m2 mouth opening (Station MSB3)

Plate 2-10 Laboratory analysis of soft bottom benthos samples with the use of a stereo zoom microscope

Coral, Seagrass/Macroalgae, Beach Vegetation and Mangrove

An ocular survey along the shoreline of the study area was conducted to obtain information on the presence of beach forest/vegetation and mangrove. Shallow water SCUBA diving activities (**Plate 2-11**) were also performed to determine the presence of coral reef and seagrass/macroalgae. Secondary data gathering from the informal interviews with the field guides/boat operators and from the various reports and literatures/publications on the coral resources of Manila Bay region was also conducted.

Plate 2-11 Coral and seagrass/seaweed rapid assessment survey using SCUBA diving equipment

Local Fisheries Resources

This study will provide baseline information on the status of the local fisheries resources in Lucanin and neighboring waters at which may be useful in formulating policies for its rational exploitation and proper management of the fisheries resources.

Field observations and informal interviews with local residents, particularly the guides, boat operators and fishermen encountered during the survey were conducted to obtain current information on local capture fishery conditions (i.e., fishing grounds, fishing boats, fishing gears and method of operation and fishes caught, etc.). Secondary data gathering from the various reports and published literatures on the municipal fish capture fisheries along the project site and Manila Bay was also conducted.

2.2.1.1.2 RESULTS AND DISCUSSION

Plankton

Phytoplankton (Photosynthetic Microalgae)

The phytoplankton and zooplankton taxa represented in the samples, their density and percent relative abundance are shown in **Table 2-30.** The phytoplankton population consists of three (3) major taxonomic groups, dominated by the diatoms (average 95.32%) followed by the dinoflagellates (average 4.08%) and the blue-green algae (average 0.60%) (**Figure 2-31**).

Table 2-30 Composition, density and relative abundance of phytoplankton and zooplankton organisms sampled at four stations established along the coast in Lucanin (Mariveles, Bataan)

PHYTOPLANKTON TAXA	STATION				MEAN TOTAL DENSITY (NO./M^3)	MEAN RELATIVE ABUNDANCE (%)
	MPL1	MPL 2	MPL3	MPL4		
Bacillariophyceae (Diatoms)						
1. Chaetoceros	1,463,414	1,206,896	1,428,571	348,837	1,111,929	24.85
2. Coconeis	24,390	17,241			10,407	0.23
3. Conscinodiscus	36,585	34,482	119,047	58,139	62,063	1.39
4. Guinardia	121,951	120,689	119,047	23,255	96,235	2.15
5. Lauderia	191,463	57,586	311,904	31,395	148,087	3.31
6. Navicula	36,585	17,241			13,456	0.30
7. Odontella	24,390	51,724	23,809	58,139	39,515	0.88
8. Pleurosigma	24,390	86,206	71,428	69,767	62,947	1.41
9. Pseudo-nitschia	109,756	-	-	-	27,439	0.61
10. Rhizosolenia	365,853	51,724	380,952	81,395	219,981	4.92
11. Skeletonema	1,463,414	2,758,620	3,333,333	1,511,627	2,266,748	50.66
12. Thalassionema	121,951	241,379	357,142	104,651	206,280	4.61
Sub-total	***3,984,142***	***4,643,788***	***6,145,233***	***2,287,205***	***4,265,087***	***95.32***
Cyanophyceae (Blue-green Algae)						
1. *Trichodesmium*	12,195	-	95,238	-	**26,858**	**0.60**
Sub-total	***12,195***	***-***	***95,238***	***-***	***26,858***	***0.60***
Dinophyceae (Dinoflagellates)						
1. *Ceratium*	60,975	34,482	95,238	11,627	**50,580**	**1.13**
2. *Dinophysis caudata*		34,482	-	-	**8,620**	**0.19**
3. *Gonyaulax*	12,195	17,241	23,809	11,627	**13,311**	**0.30**
4. Prorocentrum	-	17,241	-	116,279	**7,217**	**0.17**
5. *Protoperdinium*	60,975	137,931	95,238	-	**102,605**	**2.29**
Sub-total	***134,145***	***241,377***	***214,285***	***139,533***	***182,333***	***4.08***
Total Phytoplankton	**4,130,482**	**4,885,165**	**6,454,756**	**2,426,738**	**4,474,278**	**100.00**

PHYTOPLANKTON TAXA	STATION				MEAN TOTAL DENSITY (NO./M³)	MEAN RELATIVE ABUNDANCE (%)
	MPL1	MPL 2	MPL3	MPL4		
B. ZOOPLANKTON						
Ciliata						
1. *Codonellopsis*	12,195	51,72 4	-	11,627	18,886	10.15
2. Tintinnids	60,975	51,724	142,857	116,279	92,958	49.98
Sub-total	***73,170***	***103,448***	***142,857***	***127,906***	***111,844***	***60.13***
Copepoda						
1. Copepod Nauplius Larvae	60,975	34,482	23,809	34,883	38,537	20.72
2. Adult Calanoid Copepod	-	17,241	-	11,627	7,217	3.88
Sub-total	***60,975***	***51,723***	***23,809***	***46,510***	***45,754***	***24.60***
Appendicularia						
1. *Oikopleura*	48,780	17,241	47,619	-	28,410	15.27
Sub-total	***48,780***	***17,241***	***47,619***	***-***	***28,410***	***15.27***
Total Zooplankton	**182,925**	**172,412**	**214,285**	**174,416**	**186,008**	**100.00**
Plankton Biomass (Displacement volume in mL/m³)	**9.75**	**10.34**	**14.29**	**5.81**	**10.05**	

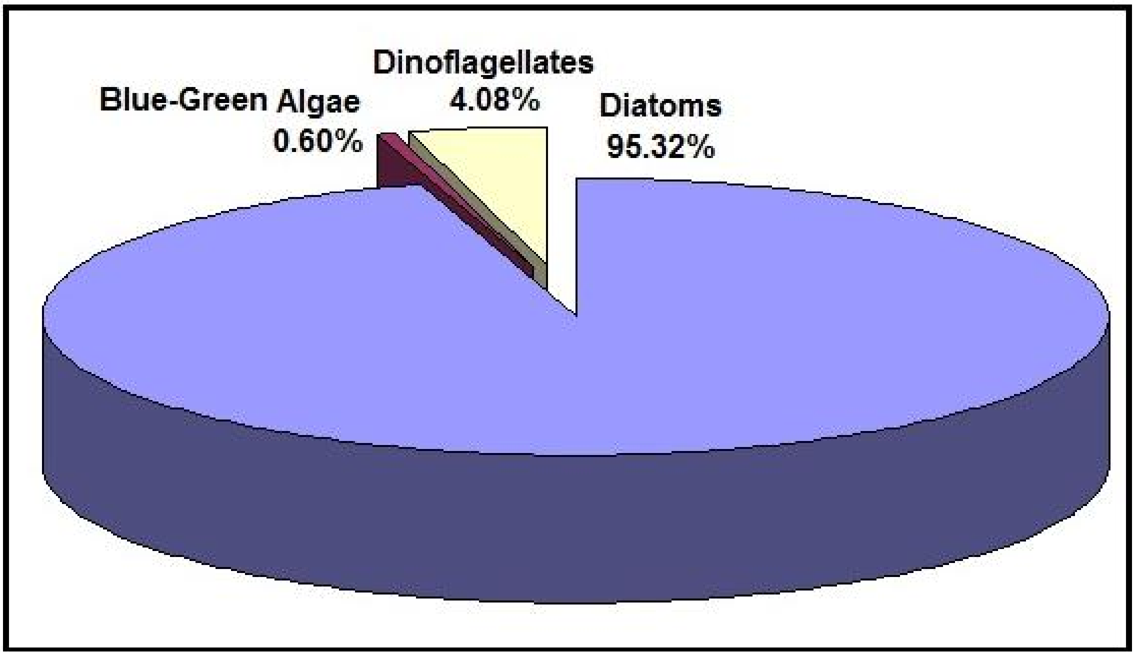

Figure 2-31 Mean relative abundance of major phytoplankton groups

Overall, the phytoplankton organisms obtained during this survey was dominated by diatom Skeletonema (average 2,266,748 cells/m3, or 50.66%) followed by other diatoms Chaetoceros (average 1,111,929 cells/m3, or 24.85%; **Plate 2-12a**), Rhizosolenia (average 219,981 cells/m3 or

4.92%; **Plate 2-12b**) and Thalassionema (average 206,280 cells/m3 or 4.61%); **Plate 2-12c**). Other phytoplankton forms were poorly represented (see **Table 2-30**and **Plate 2-12**).

Normally, the most dominant phytoplankton groups in Manila Bay are the diatoms. The results of the phytoplankton studies conducted by Gatdula et al. (2017) for the entire Manila Bay from 2012 to 2015 shows that phytoplankton community was composed of diatoms, dinoflagallates and blue-green algae. Skeletonema and Chaetoceros were also the most dominant among the diatoms. In marine waters the phytoplankton community is often dominated by diatoms-microscopic representatives of the plant phylum Chrysophyta which possesses characteristic silica impregnated cell walls; and may be extremely abundant in nearshore or bay ecosystems (Basson et al., 1977).

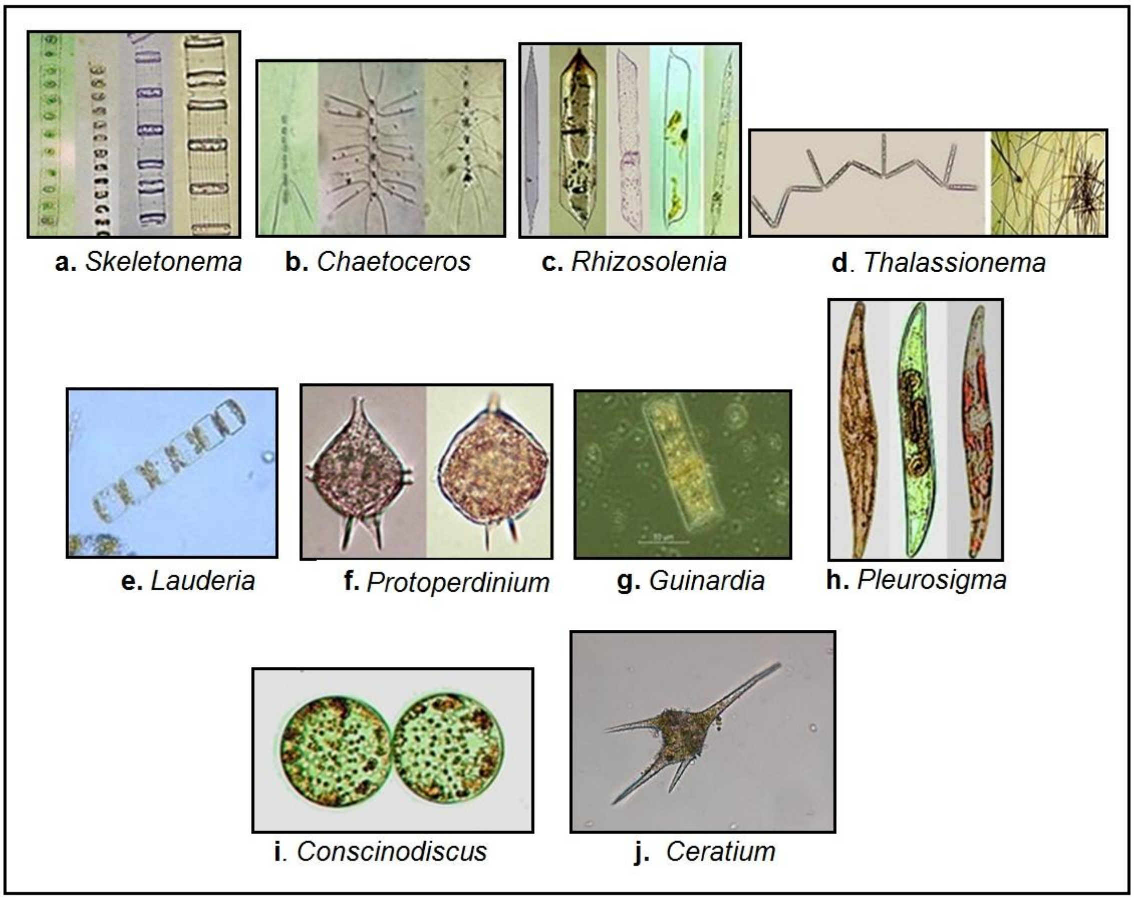

Photo Source: Internet

Plate 2-12 Most abundant phytoplankton organisms found at the four plankton stations sampled along the coast of Lucanin (Mariveles, Bataan)

In this present survey, the phytoplankton dinoflagellates were represented by five (5) taxa, dominated by Protoperidinium (average 102,605 cells/m3, or only 2.29%; see **Plate 2-12f**) followed by Ceratium sp. (average 50,580 cells/m3, or 1.13%; **Plate 2-12j**) and Gonyaulax sp. (average 13,311 cells/m3, or only 0.30%). Dinoflagellates are the common group linked with red tides or harmful algal blooms (HABs).

HABs are caused by algae, many of which are microscopic diatoms, dinoflagellates, and cyanobacteria (blue-green algae) that produce toxins or grow excessively, harming humans, other animals, including the environment (Anderson et al., 2008). In the ocean, these species commonly make their presence known through massive “blooms” of cells that discolor the water (hence the common use of the term “red tide”); through illness and death of humans who have consumed contaminated shellfish or fish; or through mass mortalities of fish, seabirds, and marine mammals along coastal shores (Hallegraeff, 1993). The spatial and temporal expansion and increased intensity of HABs is a globally recognized phenomenon (Hallegraeff, 1993; Anderson et al., 2008) and this expansion has already been observed in Manila Bay where HABs have become a human health, economic and environmental threat.

Manila Bay has seen an increased incidence of HABs over the past three (3) decades (Borja et al., 2019). The bay experiences at least two (2) distinctive types and detrimental impacts of HABs annually since 1988, which are: (i) toxins-producing algae causing a variety of illnesses in humans due to consumption of contaminated shellfish and/or fish, and (ii) mono-species blooms or “fish killer” red tide directly causing fishery economic losses due to massive fish kills of shellfish and fish from both aquaculture farms and natural environment.

Borja et al. (2019) discussed the HABs affecting the Manila Bay including their historical occurrence, causative phytoplankton species, and impacts and are summarized below.

Occurrence of Shellfish Poisoning Causative Species

The western side of Manila Bay (off Orion and Limay, Bataan) had its first experience of the blooms of toxic dinoflagellate, Pyrodinium bahamense var. compressum (**Plate 2-13**) in August 1988 which lasted until December of the same year. Consequently, there were 121 cases of paralytic shellfish poisoning (PSP) with four (4) deaths, of which, only 65 cases were validated, due to ingestion of contaminated shellfish on the said period alone. Pyrodinium bloom was observed annually since then until 1998, recording a total of 1,108 PSP cases with 44 deaths.

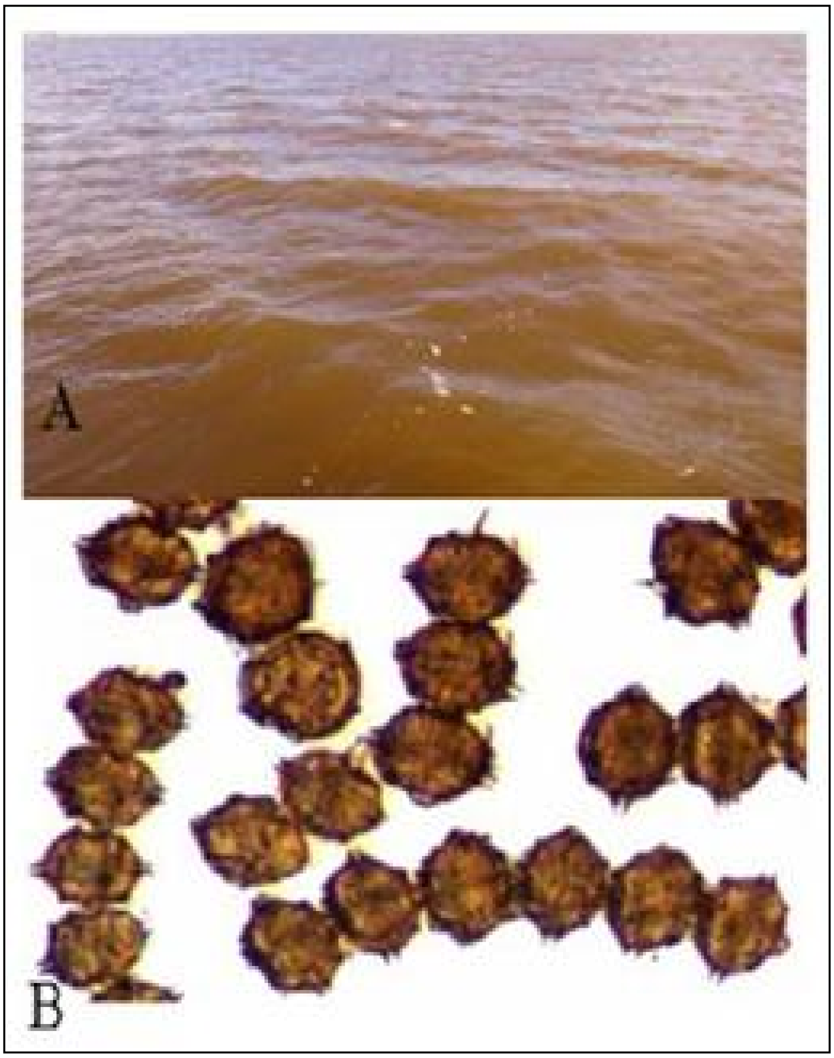

Photo Source: Borja et al. (2019)

Plate 2-13 ***Red tide/phytoplankton bloom of toxic dinoflagellate Pyrodinium bahamense var. compressum in Manila Bay during 1997-1998***

The presence of two (2) species of Alexandrium were confirmed in the bay namely, A. tamiyavanichii and A. minutum (**Plate 2-14**). Both are HAB-causative species producing PSPs. Although no incidence of PSP cases were ever reported with the occurrence of A. tamiyavanichii in the bay, on 12 January 2018 the western side of Manila Bay is positive for PSP toxin that is beyond regulatory limit. The responsible organism was A. minutum, the same species that was first detected in the coastal waters of Bolinao, Pangasinan on 22 April 2003 wherein two (2) children died out of six (6) PSP cases shortly after ingesting mussels.

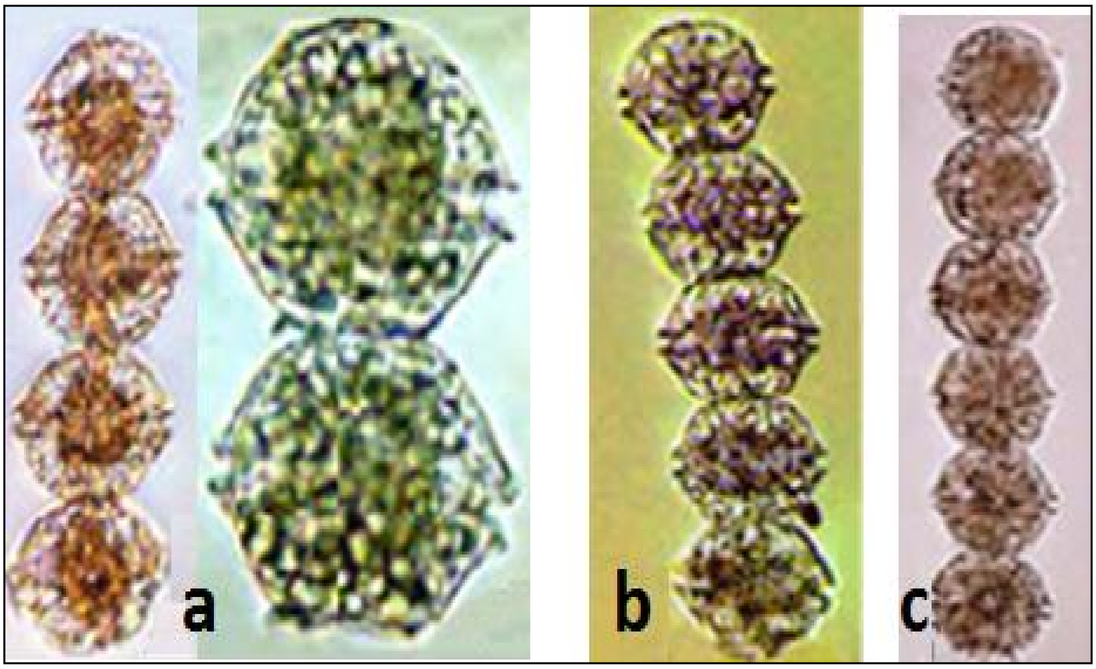

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Photo Source: Borja et al. (2019)

Plate 2-14 Three species of chain-forming dinoflagellate Alexandrium found in Manila Bay. a) Alexandium tamiyavanichii, b) Alexandrium sp. 1, and c) Alexandrium sp. 2

Gymnodinium catenatum (**Plate 2-15**) is an athecate, unarmored dinoflagellate that produces PSP toxin that was first detected in the Manila Bay in August 1990. Since then, G. catenatum were mostly detected in the western side of the bay albeit in low density but was undetected from 2012 to 2015. No PSP cases related to G. catenatum was reported in the surrounding areas of the bay.

Photo Source: Borja Borja et al. (2019

Plate 2-15 Chain-forming cells of dinoflagellate Gymnodinium catenatum found in Manila Bay

From 1999 until 2013, green Noctiluca scintillans (**Plate 2-16**) formed blooms and became more recurrent, prevalent and eventually succeeded Pyrodinium. Red N. scintillans bloom took place for the first time in the bay between the last week of January and the first week of February 2014. Although Red N. scintillans were present during the months of January to February from 2015 to 2018, density ranges of 21-35 cells/L did not produce water discoloration.

Photo source: Borja et al. (2019)

Plate 2-16 Green and red discoloration caused by dinoflagellate Noctiluca scintillans in Manila Bay in July 2012 and January 2014

In 1941, three (3) species of Dinophysis were identified by Roxas (1941) as Dinophysis miles f. indica, D. caudata and D. hastata. The first two (2) species were said to be the most common in Manila Bay while the latter was sometimes seen in Mindoro waters. Since BFAR had started HAB monitoring in 1998, the same species were also seen with an addition of Dinophysis mitra (**Plate 2-17**) the surrounding areas of the bay and there was no record of blooming of this species.

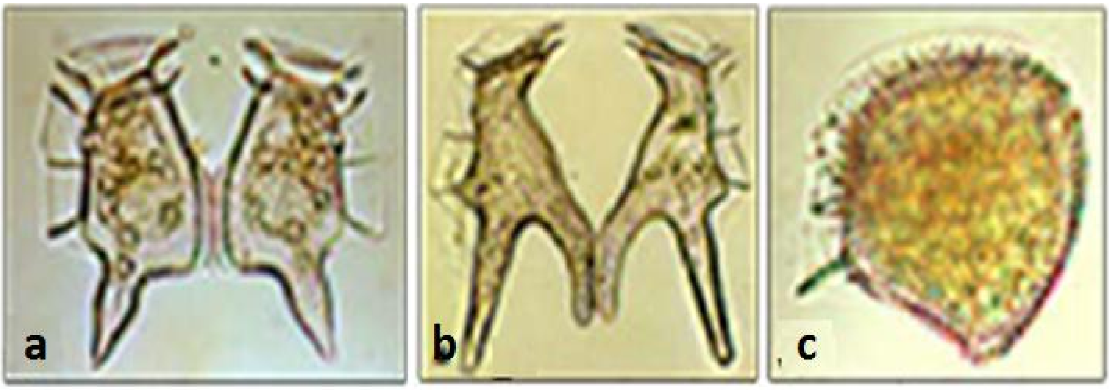


Photo Source: Borja et al. (2019)

Plate 2-17 Three dinoflagellate Dinophysis species found in Manila Bay: a) Dinophysis caudata, b) Dinophysis miles, and c) Dinophysis mitra

<u>Occurrence of Fish Killer Species</u>

In 1908, *Peridinium* sp. bloomed in the western side of Manila Bay where it had depleted the water of dissolved oxygen that led to the fish kill in the area (Gonzales, 1989). Thereafter, the bloom of this non-toxic species was observed annually in the southeastern area (Gonzales, 1989). Eleven species commonly found in Manila Bay were identified by Roxas (1941) as *Peridinium conicoides*, *P. latissimum*, *P. leonis, P. subinerme, P. depressum, P. divergens, P. obtusum*, *P. venustum, P. africanoides, P. curtipes, and P. pellucidum.* Gran had separated the genus *Peridinium* into *Protoperidinium* in 1902 to distinguish the freshwater photosynthetic *Peridinium* species from the marine non-photosynthetic *Protoperidinium* species (Ake-Castillo et al., 2011). Gatdula et al. (2017) had enumerated the *Protoperidinium* species seen in Manila Bay from 2012 to 2015 as *Protoperidinium claudicans*, *P. compressum*, *P. crassipes*, *P. denticulatum*, *P. depressum*, *P. divergens*, *P. mite*, *P. oceanicum*, *P. pallidum*, *P. pentagonum*, *P.* pyriforme, *P. steinii*, *Protoperidinium* sp., and *Peridinium quinquecome*.

The unarmored dinoflagallate *Cochlodinium polykrikoides* (**Plate 2-18**) was first seen in Manila Bay in October 2004. Few species can occasionally be detected in the waters since then, but these are in very low densities and do not cause any fisheries concern. However, in other coastal waters in the

Philippines, blooms of *C. polykrikoides* formed a rusty brown discoloration and massive fish kills particularly in the western coast of Palawan.

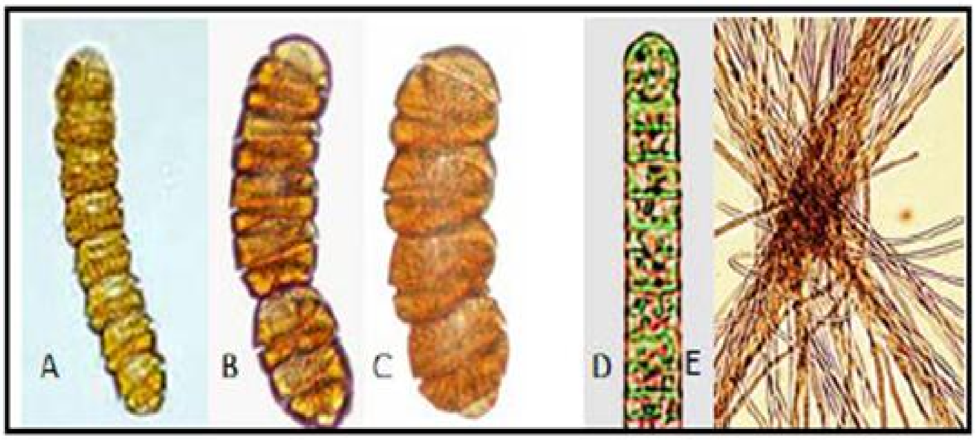


Photo Source: Borja et al. (2019)

Plate 2- 18 Harmful red tide forming phytoplankton found in Manila Bay: a-c) chain-formed unarmored dinoflagellate *Cochiodinium polykrikoides*, and d-e) filamentous cyanobacterium or blue-green alga *Trichodesmium erythraeum*

Roxas (1941) reported 11 species of *Ceratium* in Manila Bay and Puerto Galera Bay (Mindoro). *Ceratium furca* (**Plate 2- 19**) was reported to be one of the most common species, which caused fish kill in Puerto Galera Bay (Mindoro) and Balayan Bay (Batangas) in the past years. Visible reddish discoloration blooms of *C. furca* was documented in September 2012 and September 2017 on the eastern side of Manila Bay with maximum cell densities of 6,578 cells/L and 5,658 cells/L, respectively. However, no damaging effects to biotic communities were reported.

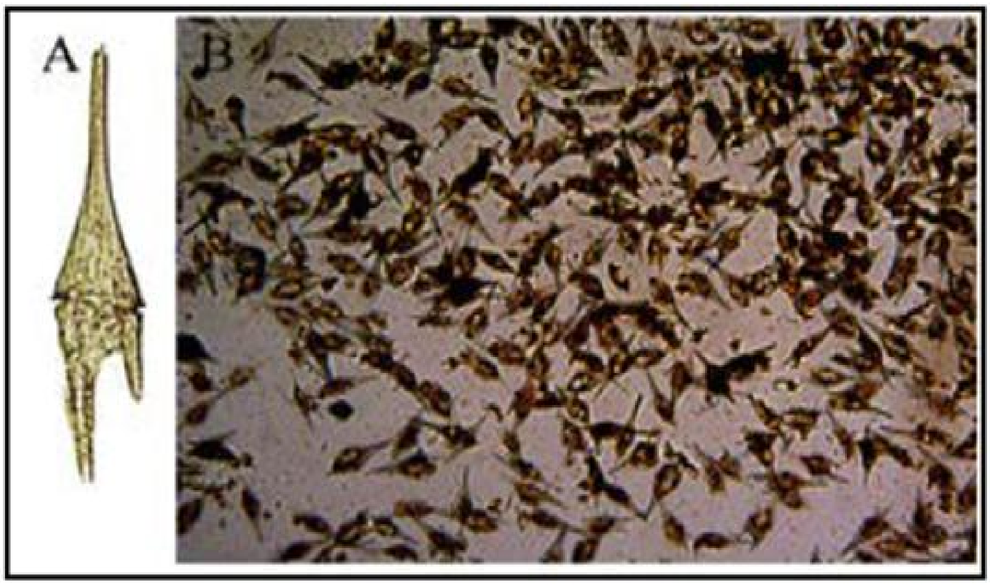


Photo Source: Borja et al. (2019)

Plate 2-19 Bloom forming armored dinoflagallate *Ceratium furca* in Manila Bay: a) single cell of *C. furca*, and b) phytoplankton bloom dominated by *C. furca*

A filamentous cyanobacterium/blue-green alga Trichodesmium erythraeum (see **Plate 2-18**), is found in tropical and sub-tropical body of waters noted for fish killing potential. So far, this species had never caused any fisheries resources trouble in Manila Bay, no information on it has been recorded.

There are two (2) diatom species causing amnesic shellfish poisoning (ASP) that has been identified in Manila Bay, namely Pseudo-nitzschia pungens and Nitzschia navis-varingica. Bajarias et al. (2006) collected samples every month from January 2005 until June of the same year. In-vitro culture revealed that P. pungens was negative for domoic acid (DA) toxin. However, N. navis-varingica isolated in southeastern side showed toxins of DA and isodomoic acid B, while N. navis-varingica from the northern part revealed toxins of isodomoic acid A and B.

To date based on this review of previous works; no occurrence of red tides or harmful algal blooms (HABs) and PSP-DSP-ASP cases have been reported near the mouth of Manila Bay including the coastal/nearshore marine waters of Mariveles (Bataan), Corregidor Island, and Naic (Cavite). It may be hypothesized that the strongest tidal current velocities at the mouth of the bay prevent algal blooms.

Currently, no occurrence of red tides or HABS and PSP-DSP-ASP cases were reported in Manila Bay. The last reported case of red tide/PSP toxin was in January 2018 along the west side of Manila Bay. The responsible dinoflagellate organism was Alexandrium minutum.

Comparison among the four (4) plankton stations sampled as shown in Table 2-30**Table 2-30** and plotted in **Figure 2-32** indicated that phytoplankton counts ranged from 2,426,738 to 6,454,756 cells/m3, with the highest phytoplankton count recorded at Station MPL3 while the lowest was observed at Station MPL4. A mean total density of 4,474,278 cells/m3 phytoplankton organisms for all the stations sampled was obtained (see **Figure 2-32**).

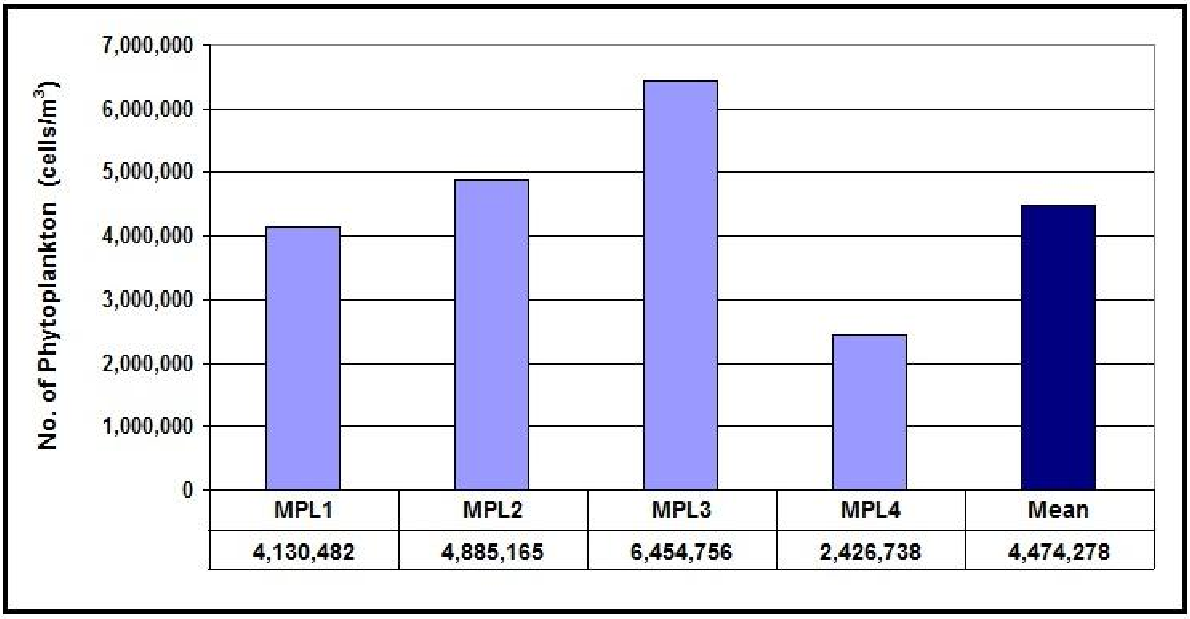


Figure 2-32 Variation of total phytoplankton organisms sampled at each sampling

Zooplankton (Animal Plankton)

The zooplankton taxa represented in the samples, their density, and percent relative abundance are also shown in **Table 2-30**. The zooplankton population consists of three (3) major taxonomic groups: the most abundant zooplankton organisms were the ciliates (average 111,844 organisms/m^3, or 60.13% of the total zooplankton population) followed by copepods. The least numerically abundant zooplankton was the appendicularians (average 28,410 organisms/m^3, or 15.27%) (**Figure 2-33**Figure 2-31).

Overall, the zooplankton organisms sampled were dominated by the ciliate tintinnids (average 18,886 organisms/m^3 or 49.98%; see **Table 2-30; Plate 2-20a**) followed by copepod nauplius larvae (average 38,537 organisms/m^3 or 20.72%; see **Table 2-30** and **Plate 2-20b**), appendicularia *Oikopleura* (average 28,410 organisms/m^3, or 15.27%; see **Table 2-30**and **Plate 2-20c**), ciliate *Codonellopsis* (average 28,410 organisms/m^3, or 10.15%; see **Table 2-30** and **Plate 2-20d**).

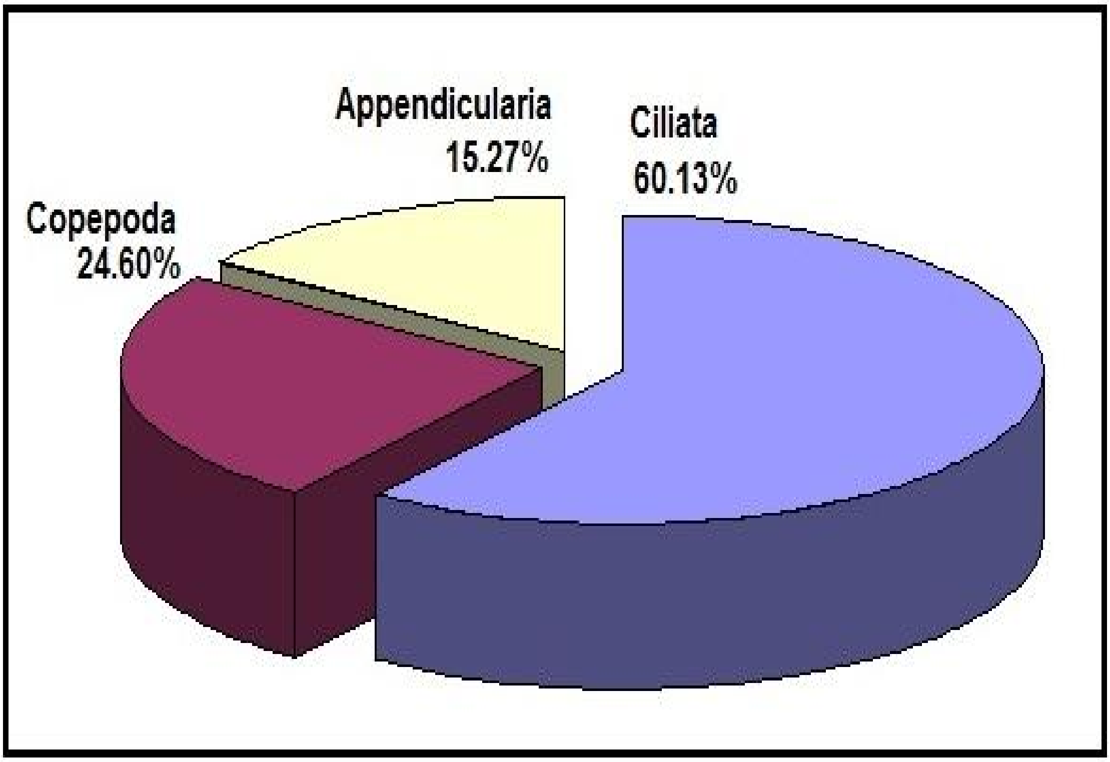


Figure 2- 33 Mean relative abundance of major zooplankton groups

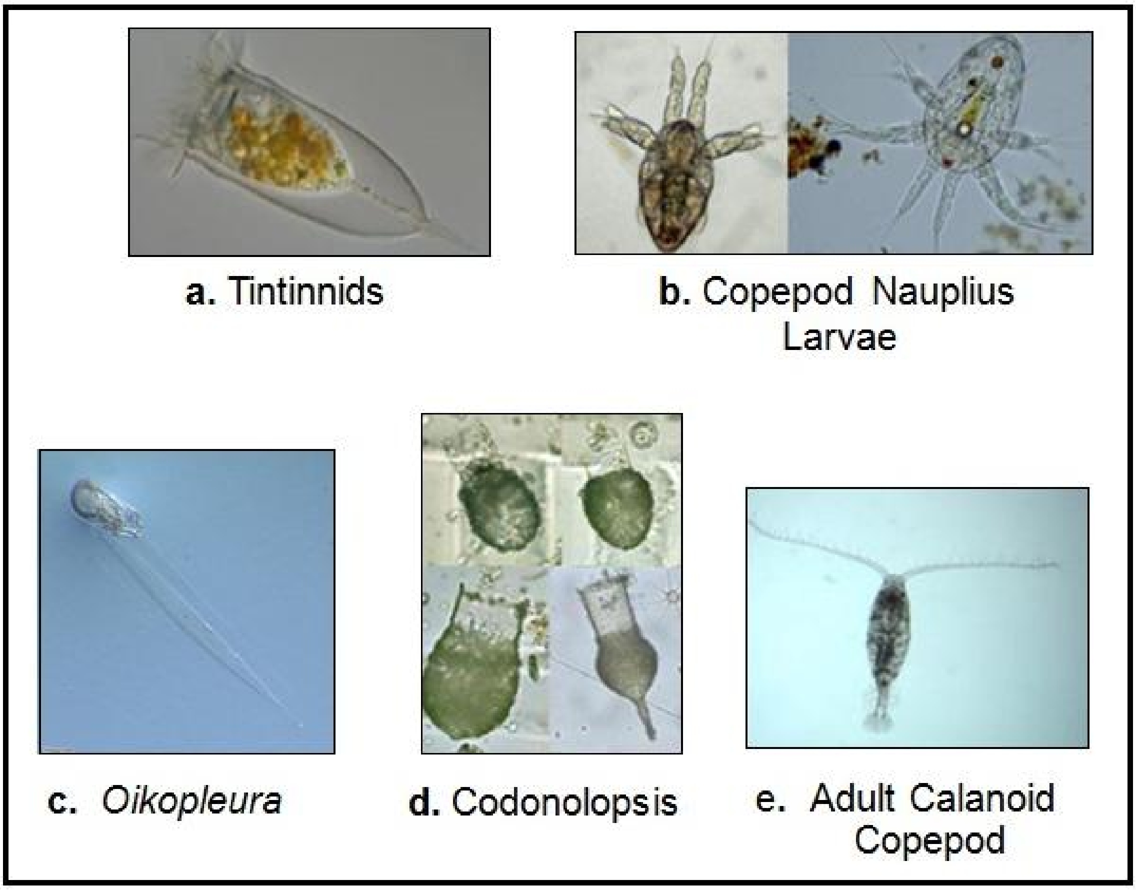


Photo Source: Internet

Plate 2-20 Zooplankton organisms found present at the four stations sampled along the coast of Lucanin (Mariveles, Bataan)

The estimates of the total zooplankton at each station are plotted in **Figure 2-34**. Zooplankton counts ranged from 172,412 to 214,285 organisms/m3, with the highest zooplankton count recorded at Station MPL3 while the lowest was observed at Station MPL2. A mean total density of 186,008 zooplankton organisms/m3 for all the four (4) stations sampled was obtained (see **Figure 2-34**).

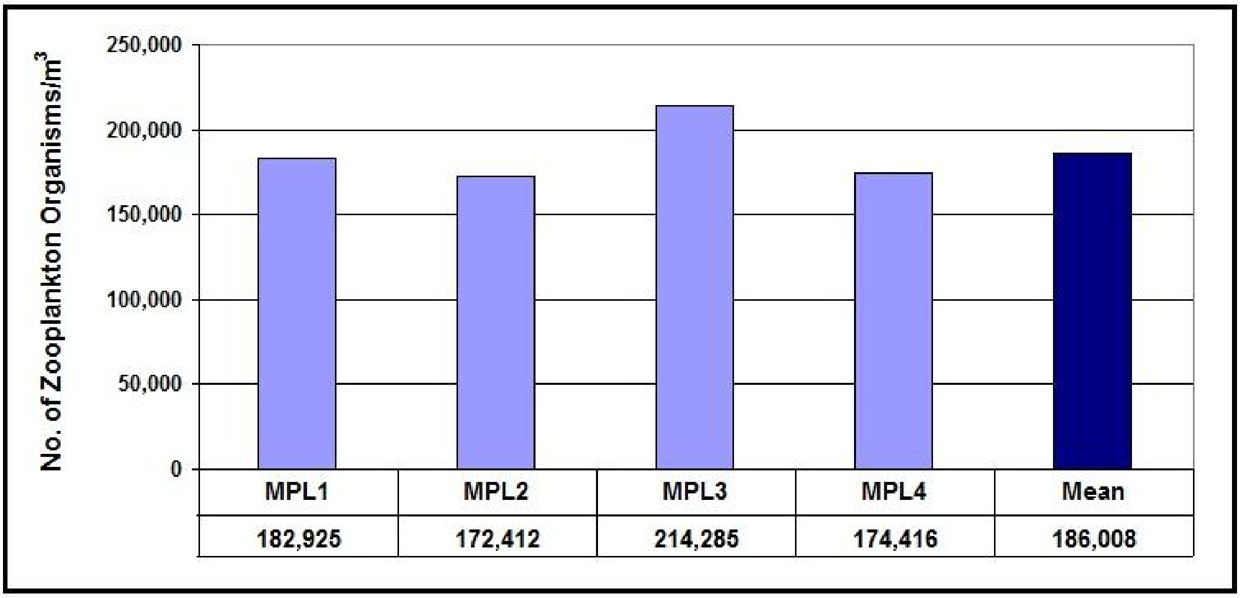


Figure 2-34 Variation of total zooplankton sampled at each plankton station

Mean Relative Abundance of Major Plankton Groups

The overall marine plankton organisms in this study were dominated by phytoplankton (96.01% of the total plankton catches), while zooplankton accounted for only 3.99% (**Figure 2-35**) which indicates that the density of the phytoplankton in the area appears sufficient to support a substantial food base.

The preponderance of phytoplankton is to be expected since they represent the primary producers or "grass of the sea" forming the base of the food web. Typically, nearshore plankton in the Philippines is dominated by phytoplankton. In a study of nearshore plankton in Mauban, Quezon (Pacific Ocean side) (WCPI, 1998,1999), it was found that phytoplankton population densities in October 1998 and August 1999 made up of about over 99% and 86%, respectively. In Villanueva (Macajalar Bay, Mindanao), the general plankton population in September 2011 was dominated by phytoplankton with 94% while the zooplankton accounted for only 6% (BSI, 2011).

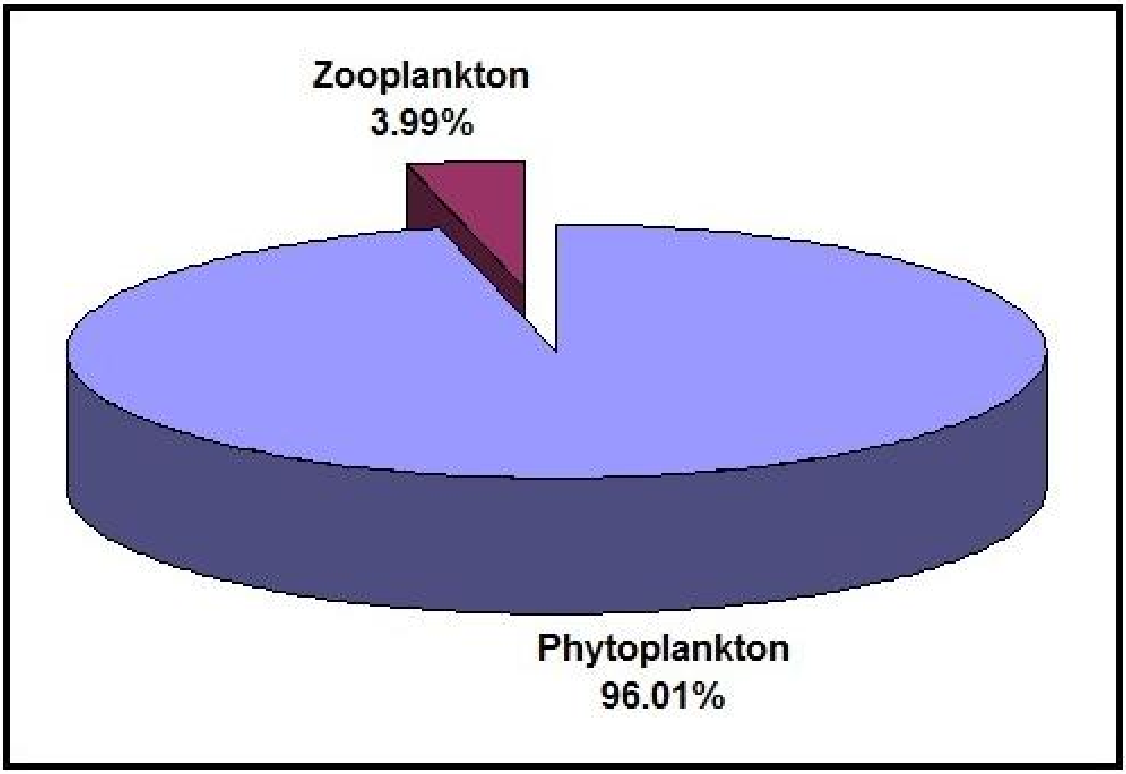


Figure 2-35 Mean percentage relative abundance of major plankton groups

Plankton Biomass

The estimated wet displacement volumes or biomasses of the plankton samples collected ranged from 5.81 to 14.29 mL/m3 (**Figure 2-36**), with the highest plankton biomass recorded at Staton MPL3 while the lowest was recorded at Station MPL4. An average of 10.05 mL/m3 was estimated for the four stations sampled.

Variation of the plankton biomass at each of the sampling stations (see **Figure 2-36**) coincided with that of the variation pattern of total phytoplankton (see **Figure 2-32**) and more or less showed a simiar general trend with that of the total zooplankton (see **Figure 2-34**). This indicates that the variates increase and decrease together, i.e., with high phytoplankton and zooplankton, more plankton biomass (displacement volume) may be expected and with low phytoplankton and zooplankton, less plankton biomass may be expected. This relationship may be explained on the basis of the major role of the phytoplankton groups. The diatoms in particular may be considered as biomass contributors in view of their abundance / dominance. Relatively larger zooplankton individuals may be also responsible for higher volume displacement. Their relatively larger dimensions contributed greatly to the biomass but little to the number.

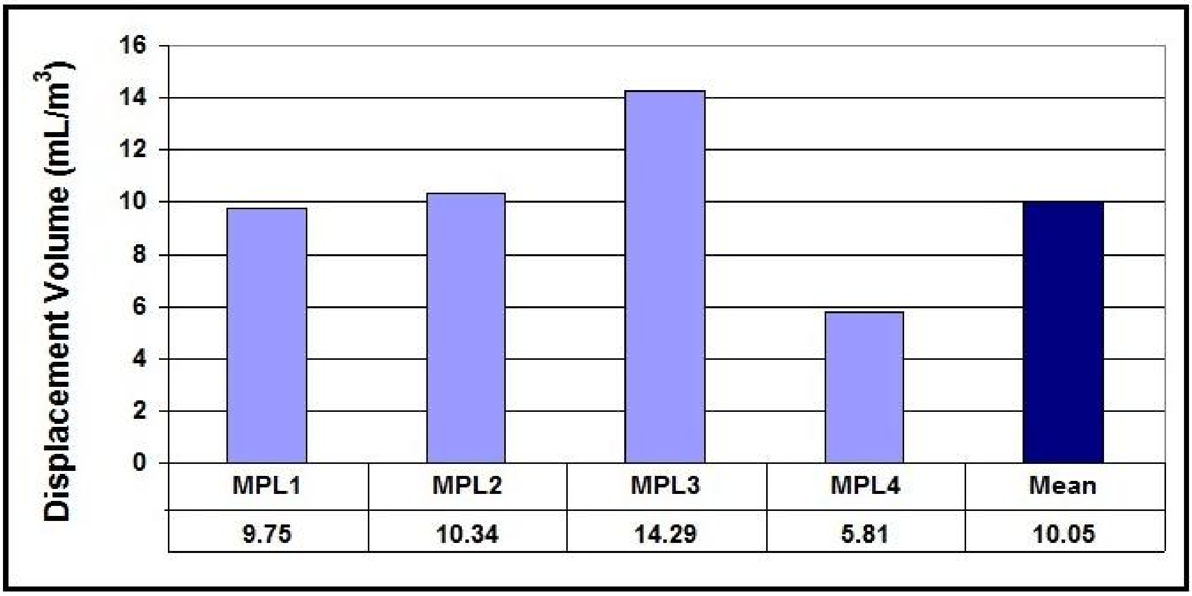


Figure 2-36 Variation of plankton biomass in vertical hauls at each sampling station

Soft Bottom Infaunal Benthos

<u>Species Composition and Relative Abundance</u>

Table 2-31 presents the species composition, density and relative abundance of the major taxonomic groups of soft bottom benthic infauna sampled during the survey. The arthropods were the most abundant organisms collected comprising 35.28% of the total collection (**Figure 2-37**), followed in decreasing order by annelids (31.26%), molluscs (19.40%), sipunculids (6.52%), and nemerteans (1.84%).

Overall, the most abundant infaunal benthic organisms found in all stations were the arthropod Family Gammaridae (average 311 indv/m2, or 26.00%; see **Table 2-31**, **Plate 2-21a**), followed by the gastropod mollusc Family Nassaridae (average 122 indv/m2, or 10.20%; see **Table 2-31** and **Plate 2-21b**), polychaete annelid Family Spionidae (average 111 indv/m2, or 9.28%; see **Table 2-31** and **Plate 2-21**c), sipunculids (average 78 indv/m2, or 6.52%; see **Table 2-31** and **Plate 2-21d**), pelecypod mollusc Family Tellinidae (average 77 indv/m2, or 6.44%; see **Table 2-31** and **Plate 2-21e**), and foraminiferan Family Millionidae (average 67 indv/m2, or 5.60%; see **Table 2-31** and **Plate 2-21f**). Examples of photos of other infaunal benthos (in order of their relative abundances) found during the survey are also shown in **Plate 2-21**.

Table 2-31 Species composition, density, relative abundance and biomass of infaunal benthos at each sampling station

TAXON	STATION				MEAN DENSITY (INDV/M^2)	MEAN RELATIVE ABUNDANCE (%)	
	MSB1	MSB2	MSB3	MSB4		SPECIES	GROUP
Phylum Foraminifera							5.60
Class Tubothalamea							
Order Miliolidae							
Family Miliolidae			267		67	5.60	
Phylum Sipunculida	44	89	133	44	78	6.52	6.52
Phylum Nemertea							1.84
Class Rhynchocoela	44			44	22	1.84	
Phylum Annelida							31.36
Class Polychaeta							
Family Orbiniidae				44	11	0.92	
Family Capitellidae			44	89	33	2.76	
Famly Spionidae	133	89	133	89	111	9.28	
Family Amphinomidae		44	222		66	5.52	
Family Opheliidae		44			11	0.92	
Family Poecilochaetidae				44	11	0.92	
Family Pilargidae		89	89		44	3.68	
Family Nephthyidae				89	22	1.84	
Family Lumbrineridae			133		33	2.76	
Family Sternaspidae				133	33	2.76	
Phylum Mollusca							19.40
Class Bivalvia							
Family Tellinidae		44	267		77	6.44	
Class Gastropoda							
Family Nassariidae			311	178	122	10.20	
Family Olividae			44		11	0.92	
Family Turridae			44		11	0.92	
Family Terebridae			44		11	0.92	
Phylum Arthropoda							35.28
Subphylum Crustacea							
Class Malacostraca							
Order Cumacea	44			44	22	1.84	
Order Tanaidacea				267	67	5.60	
Order Amphipoda							
Family Gammaridea	800		133	311	311	26.00	
Order Mysidacea		44			11	0.92	
Order Decapoda							
Family Pinnotheridae			44		11	0.92	
Total Density (no./m^2)	**1,065**	**443**	**1,908**	**1,376**	**1,196**	**100.00**	**100.00**
Total No. of Taxa	**5**	**7**	**14**	**12**	**23**		

TAXON	STATION				MEAN DENSITY (INDV/M^2)	MEAN RELATIVE ABUNDANCE (%)	
	MSB1	MSB2	MSB3	MSB4		SPECIES	GROUP
Benthos Biomass (Wet weight in g/m^2)	**8.88**	**1.30**	**106.22**	**35.55**	**37.99**		

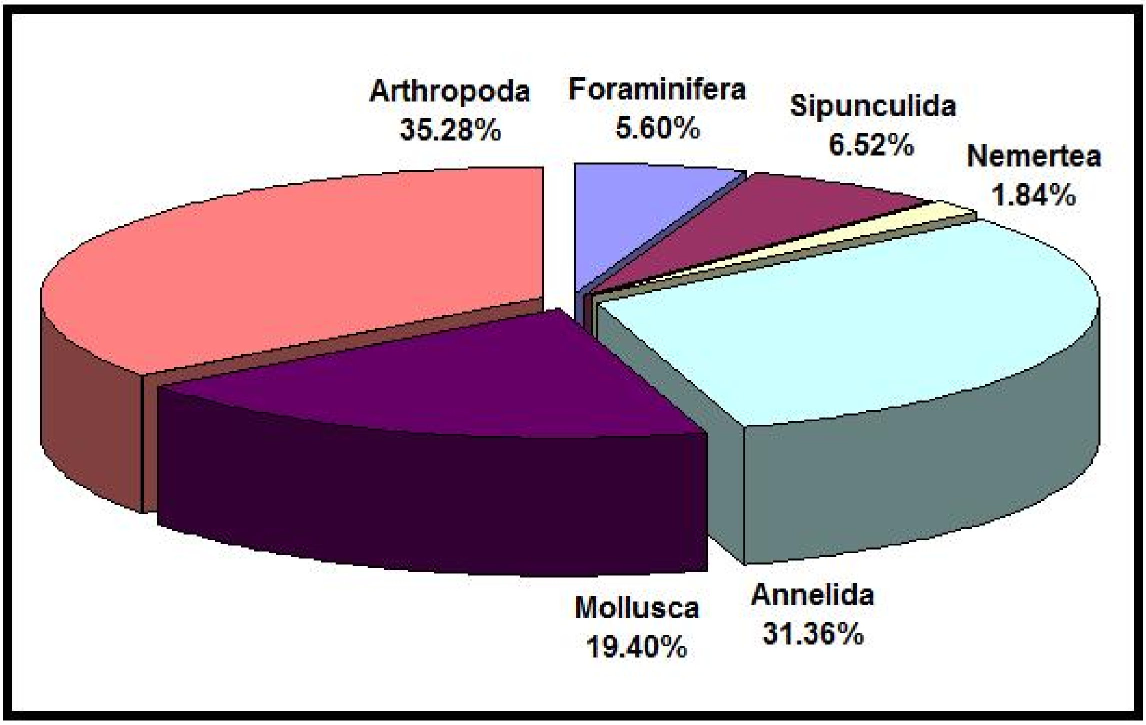


Figure 2-37 Mean relative abundance of major soft bottom infaunal benthic groups

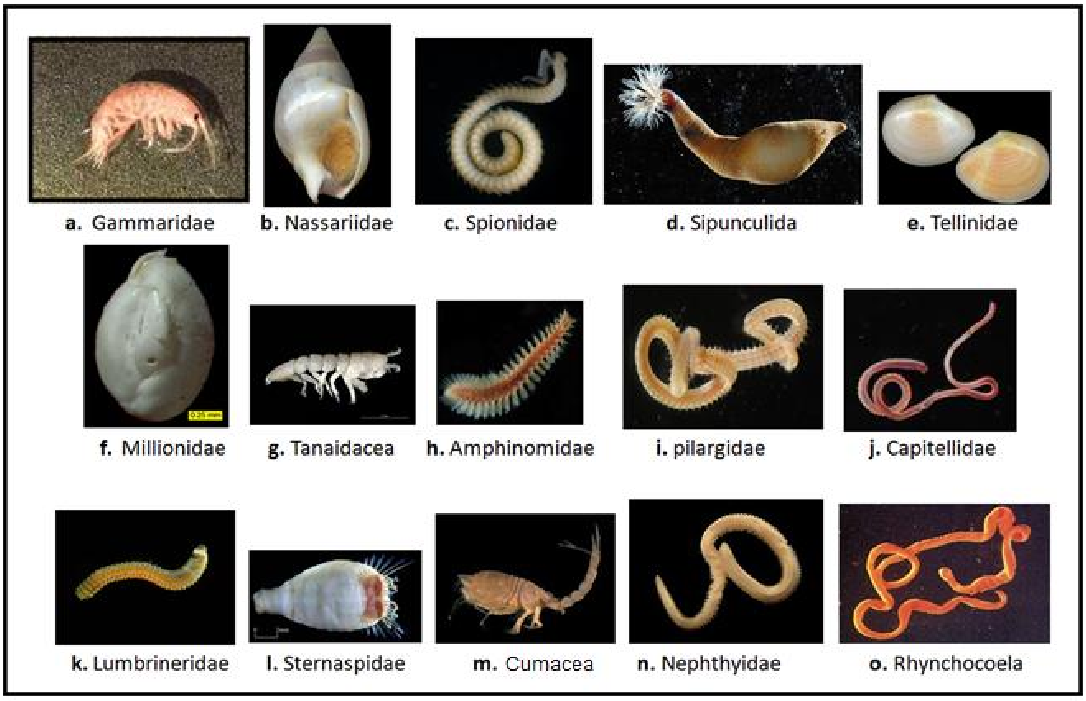


Plate 2- 21 Soft bottom infaunal benthic organisms found in the sediments sampled during the survey (Photo source: Internet)

Density

The abundance of benthic organisms was found to be variable among the four (4) sampling stations, and ranged from 443 to 1,908 indv/m2, with the highest density recorded at Station MSB3 while the lowest was recorded at Station MSB2 (**Figure 2- 38**). Mean total density was estimated at 1,196 indv/m2.

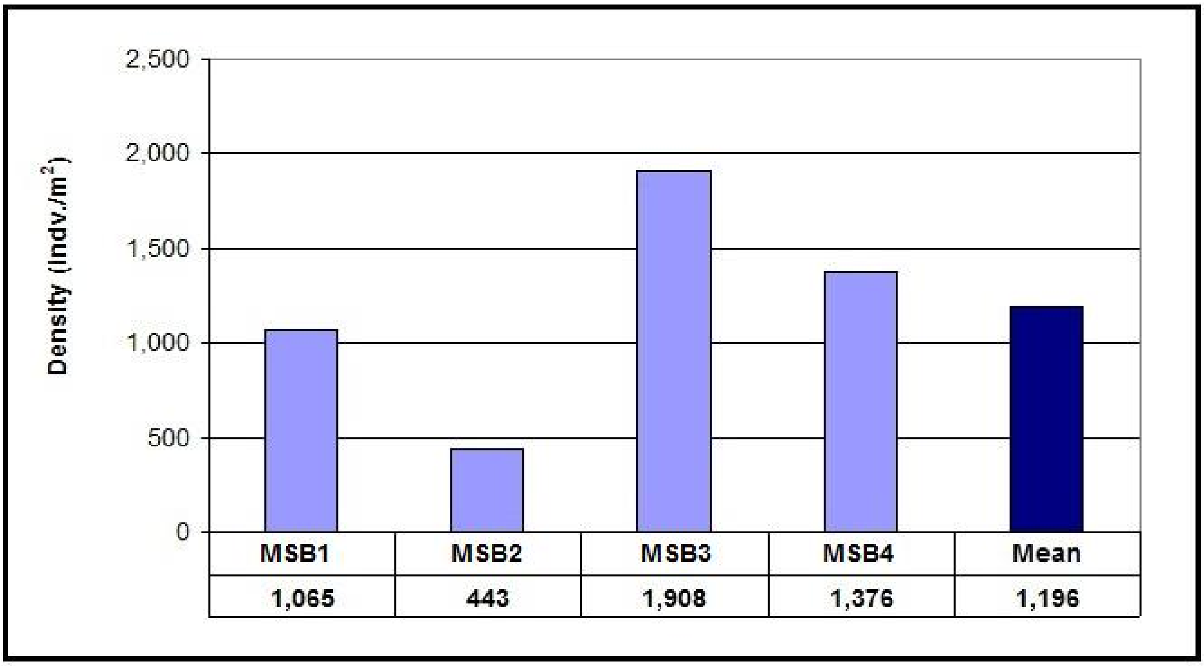


Figure 2- 38 Density of infaunal benthos found at each sampling station

Benthos Biomass

Macroinvertebrate biomass (weight of organisms per unit area) is a useful quantitative estimation of standing crop. Standing crop and species richness or numbers of taxa in a community are highly sensitive to environmental perturbations resulting from the introduction of contaminants.

Biomass of the benthic organisms in all sampling stations is also shown in **Table 2- 31** and graphically presented in **Figure 2- 39** below. The biomass ranged widely from 1.30 to 106.22 wwt g/m2. Inter-station comparison showed Station MSB3 with the highest biomass (106.22 wwt g/m2), while Station MSB3 had the least biomass (1.30 wwt g/m2). The mean biomass value recorded for all the four (4) stations was 37.99 wwt g/m2.

Variation of the benthos biomass at each of the sampling stations (see **Figure 2- 39**) more or less coincided with that of the variation pattern of total density (see **Figure 2- 38**).

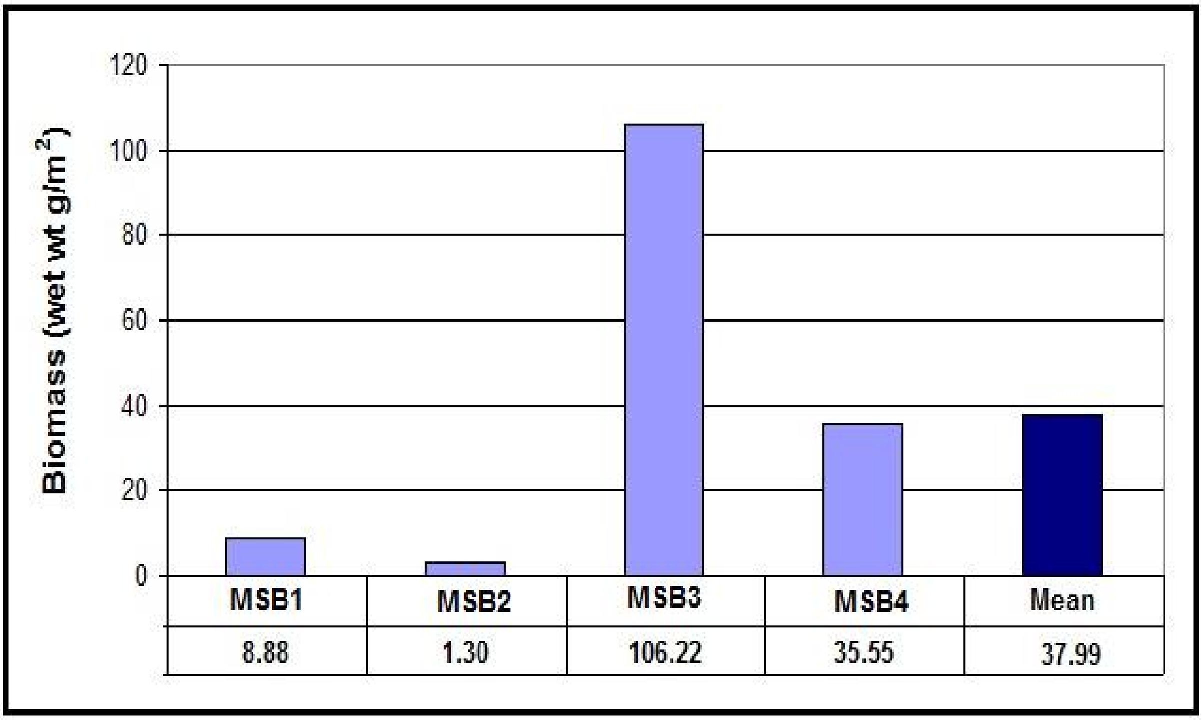


Figure 2- 39 Biomass of infaunal benthos found at each sampling station

Coral, Seagrass/Macroalgae, Beach Vegetation and Mangrove

The bottom ecology of the nearshore/coastal marine environment within the study area is characterized by generally sandy to muddy substrate with patches of rocky outcrops. Based on the results of the present field investigation, the study area and immediate vicinities have no sensitive biological communities (SBCs) such as coral reef, seagrass bed, and mangrove. However, patches of the edible macrobenthic/seaweed green alga *Caulerpa racemosa* were sighted attached on the rocky outcrops along the shallow subtidal area at less than one (1) meter water depth (Lat. 14°28’00.50” North and Long. 120°36’15.20” East. (**Figure 2- 40**). Another macroalgae or seaweeds that were observed on these rocky ourcrops were the brown alga *Padina* sp. and an unidentified green alga. On the other hand, the exposed coastal sandy beach is dominated by stands of small, perennial, thorny tree, the aroma (*Acacia farnesiana*) and several talisai trees (*Terminalia catappa*). Upper portion of the sandy beach is heavily covered with assorted garbage (mostly plastic trash).

Figure 2-40 Location of the rocky outcrops along the shoreline within the study area (inset: a. the green alga *Caulerpa racemosa*, b. the brown alga *Padina* sp. and c. the an unidentified green alga, typically found attached to rocky outcrops)

Results of the coral reef habitat assessment based on the present literature survey conducted indicate that there are limited coral reef areas within Manila Bay. The reefs within the Manila Bay are concentrated close to the mouth of the bay. The major reef areas are specifically found along the southern Cavite coastline in the municipalities of Ternate and Maragondon. Along the Bataan coast, reefs are found only in the municipalities of Limay (Lamao Point to Petron pier) and Mariveles (Lucanin and Alas-asin). Coral reefs are also found in Corregidor and Caballo Islands. Distribution of these reefs within the bay is shown in **F**

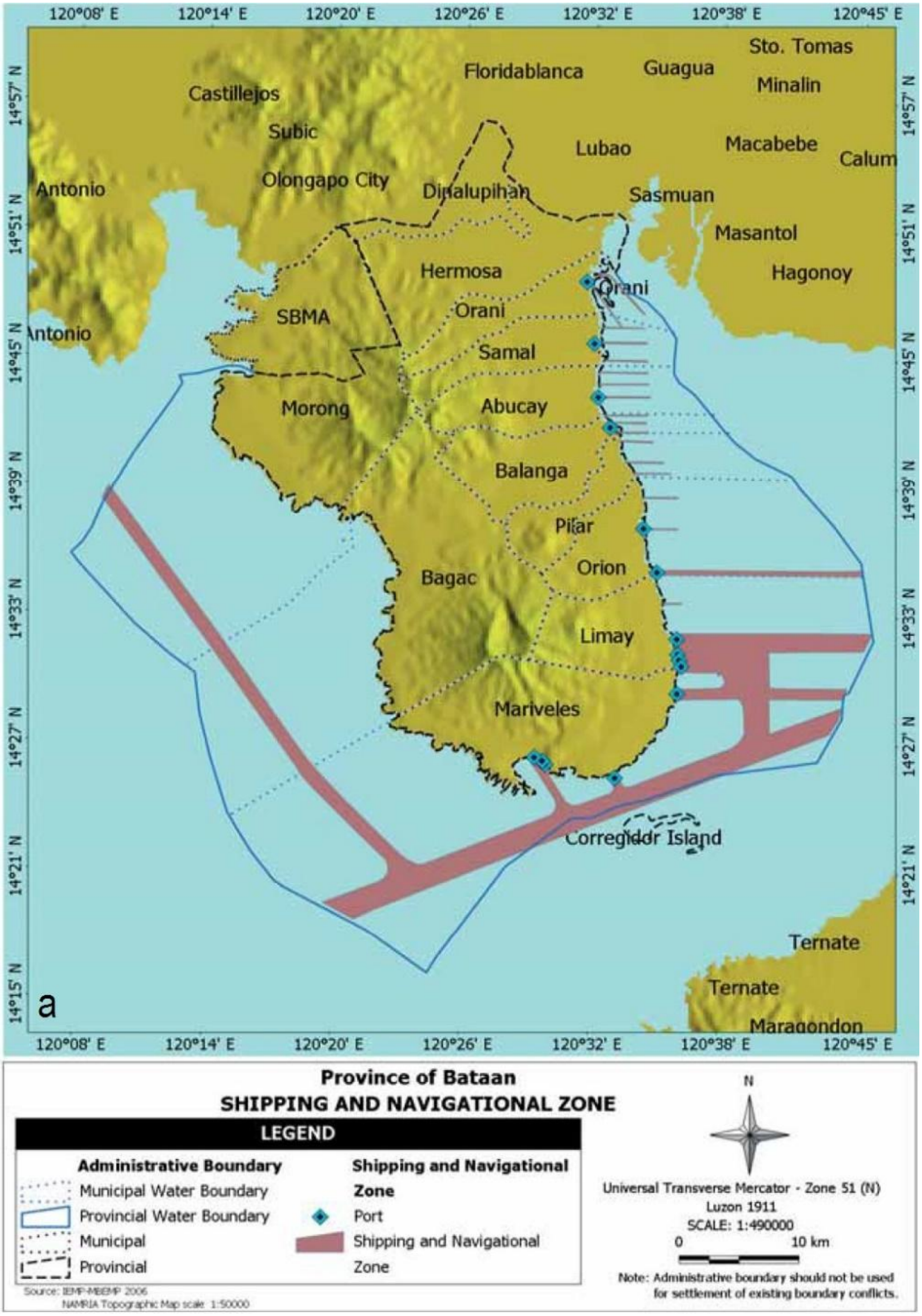
Figure 2-41**.**

Data Source: MADECOR and National Museum (1994), Bonga et al. (1996), and DENR-ERDB (2019

Figure 2-41 Distribution of coral habitats within Manila Bay

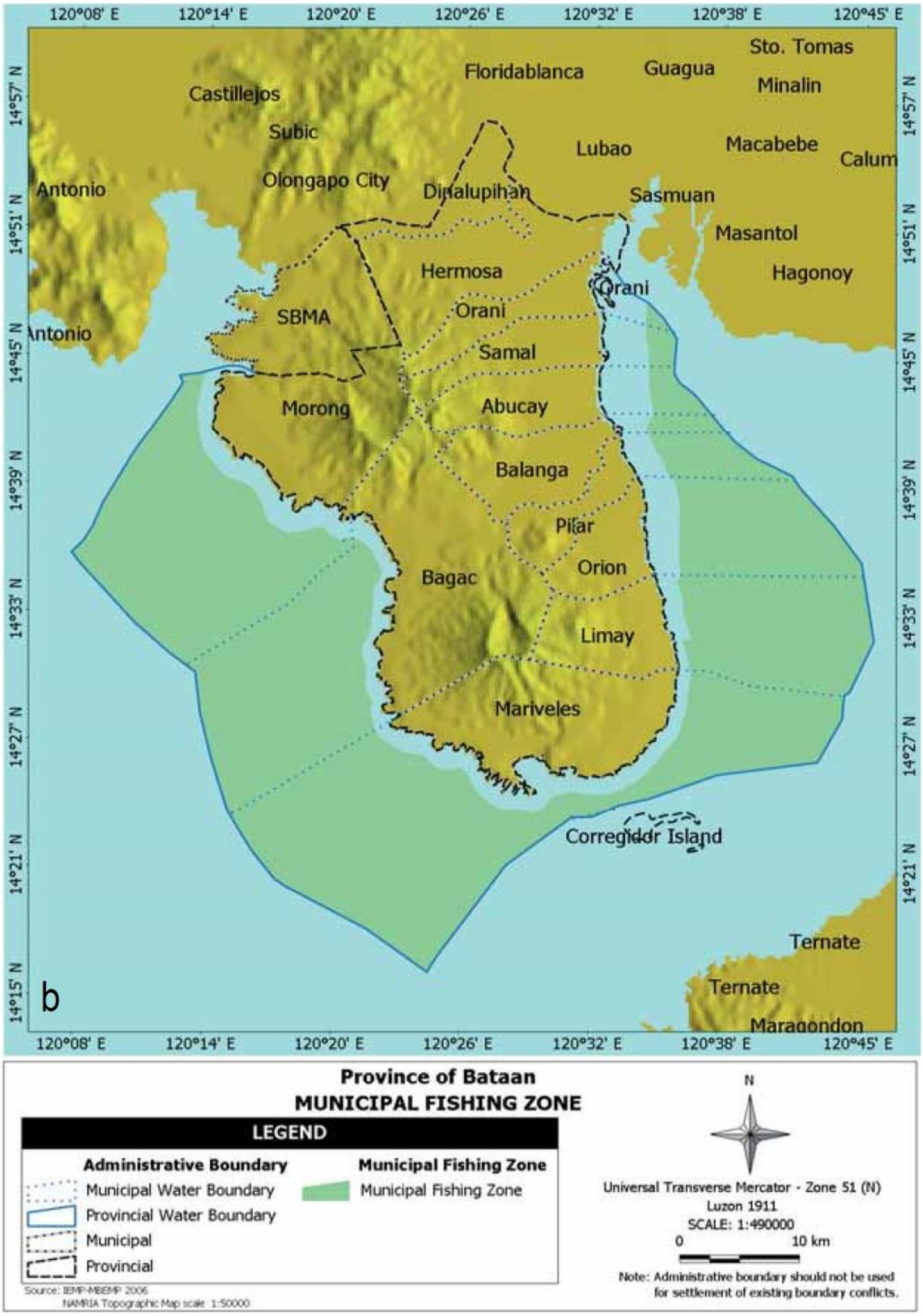
Local Fisheries Resources

The shorelines of Barangays Sisiman, Baseco, Alas-asin, Mt. View, Cabcaben, Lucanin, and Batangas II are classified as the Bataan ecozones (industrial zone). The coastal waters of Mariveles are considered as shipping and navigational zone based on the Philippine Ports Authority (PPA) and Coast Guard standard (**Figure 2-42**). The municipal fishing zone inside Manila Bay which is located up to about 17 km seaward from the shoreline of Bataan is shown in **Figure 2-43,** while the traditional fishing zone is shown in **Figure 2-44**. Municipal fishing zone refers to fishing activities within municipal waters using small-sized and medium-sized fishing vessels of three (3) gross tons or less. Trawling ("galadgad") and modified Danish seine ("hulbot-hulbot" or "buli-buli") and other destructive forms of fishing are strictly prohibited. On the other hand, traditional fishing zone covers areas where the traditional form of fishing is practiced with the used of gears, such as hook and line ("kawil"), spear gun ('pamana"), scoop net ("panalok"), snares ("panukot"), and cover pot ("pangilaw") for subsistence.



Map Source: PEMSEA and the Provincial Government of Bataan, 2007)

Figure 2- 42 Shipping and Navigational Zone of Bataan Province



Map Source: PEMSEA and the Provincial Government of Bataan, 2007)

Figure 2- 43 Municipal Fishing Zone of Bataan Province

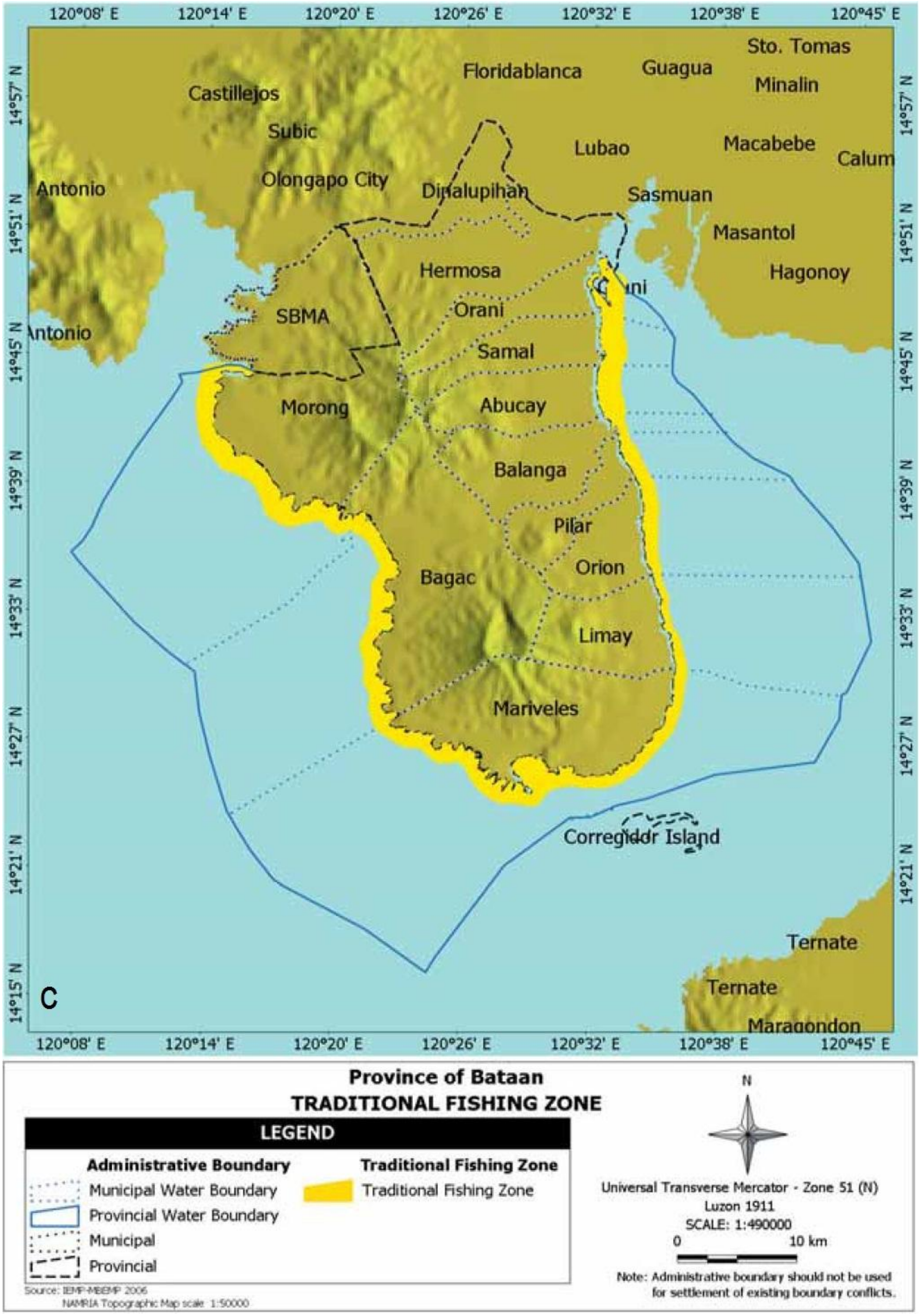


Figure 2- 44 Traditional Fishing Zone of Bataan Province

Manila Bay is one of the major fishing grounds of the Philippines. It is a multi-gear and multispecies fisheries with moderately flat bottom contour particularly suited for trawl and other similar fishing operations involving dragging or pushing nets. The bottom substrate of the entire bay is classified as sandy muddy. Fisheries and aquaculture are major sources of livelihood in areas surrounding the bay (PEMSEA, MBEMP-MBIN, 2007). Recent studies already show that the Bay's resources are experiencing overfishing as proven by the declining fish catch and in the change of the quality of fish caught to lesser valued species (Dicdiquin et al., 2017). In addition, the Bay is also suffering from habitat degradation and its water quality is deteriorating due to pollution (PEMSEA and MBE TWG-RRA, 2004; Su et al., 2009; Chang et al., 2009).

The municipal fishery is an important economic sector in the study area. The types of marine fishery habitats along the project area vary from soft bottom (sandy to muddy) substrates typically inhabited by demersal (bottom dwelling) fishes, to artificial hard substrates (pier/jetty areas), as well as areas encompassing the open water or pelagic fishery. The fishing activities along the project area can be categorized as municipal or sustenance. Most fishers are operating in the entire coastal areas along the barangay and neighboring marine waters in Manila Bay while some of the commercial fishing boats are fishing in the West Philippine Sea.

The fishing season in the area is all year round with peak season during rainy months June to August and also during summer months March to May. The local fisheries resources of the area also includes fishing activities without the use of boats, like trapping, fry gathering with scissor nets, and other passive and or non mobile gear types. The major fishing gears being used in Mariveles are bottom gillnet ("panting lubog"), bottom set longline ("kitang"), drift gill net ("panting paanod"), crab gill net ("panti pang alimasag"), motorized push net ("pang alamang"), hook and line ("kawil"), spear gun ("pana"), and crab pot ("bubo pang alimasag") (**Figure 2-39**). The types of fishes caught in the area are primarily dictated by the type of fishing gear that the fishers employ. There are two (2) general types of fishes caught in the area, the pelagic species and the demersal species (or soft bottom dwellers/feeders). Fishing gears target either the pelagic or demersal species. However, there are fishing gears targeting one (1) of the two (2) types but can also catch the other type. Examples of photos of some of the common pelagic and demersal fish species caught in Lucanin and neighboring waters are presented in **Photo source**: *Internet searches)*

Plate 2-23 and **Plate 2-24.**

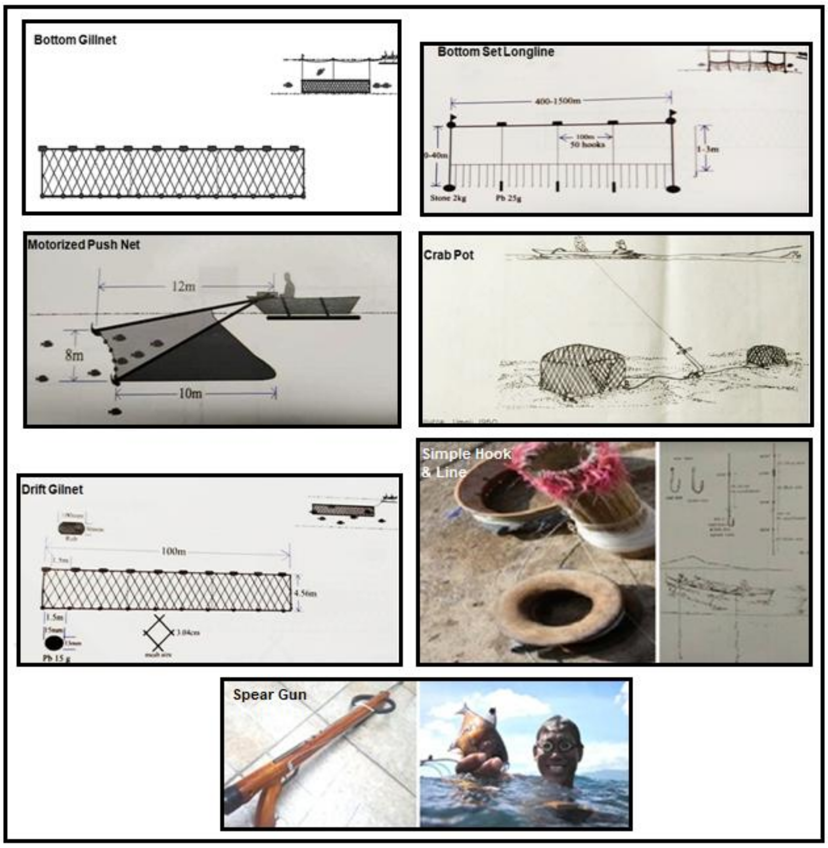


Plate 2- 22 The major municipal fishing gears and method of operations being used in Lucanin and adjacent waters (Mariveles, Bataan)

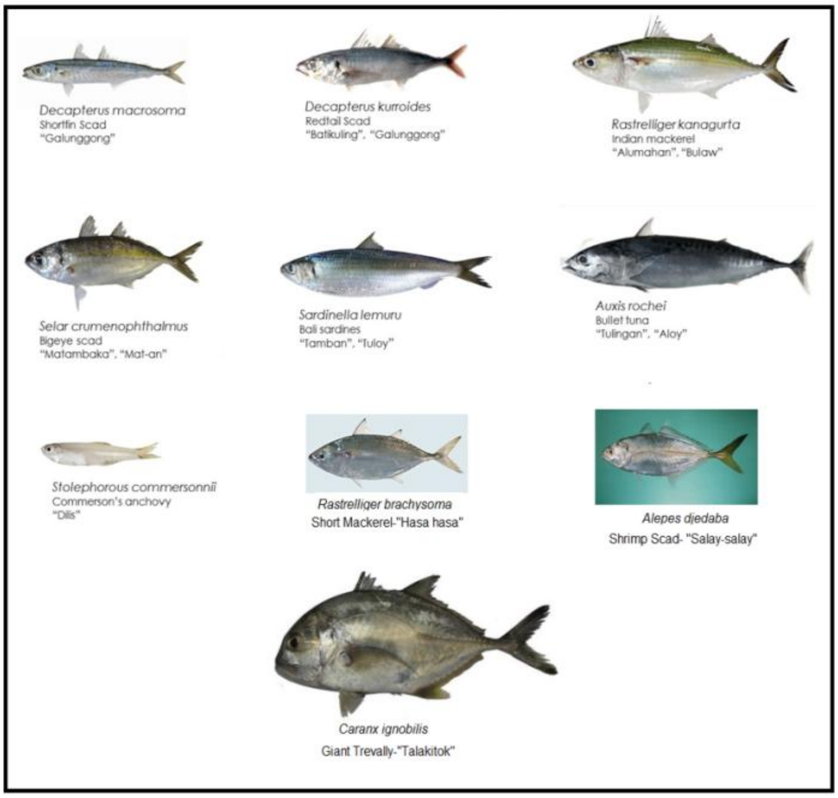


Photo source: Internet searches)

Plate 2- 23 Examples of photos of some of the common pelagic fish species caught in Lucanin and adjacent waters

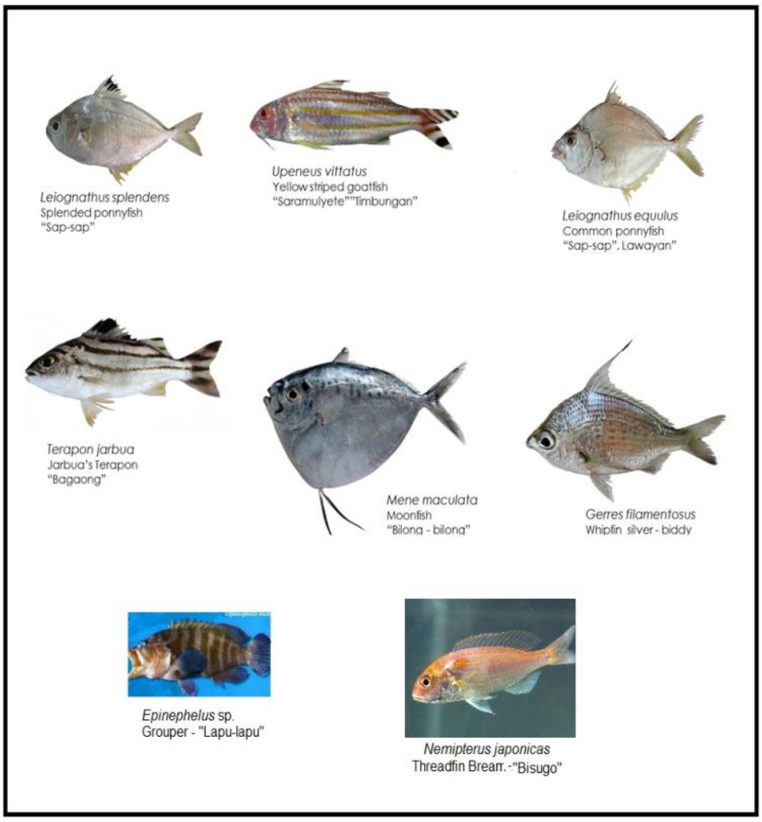
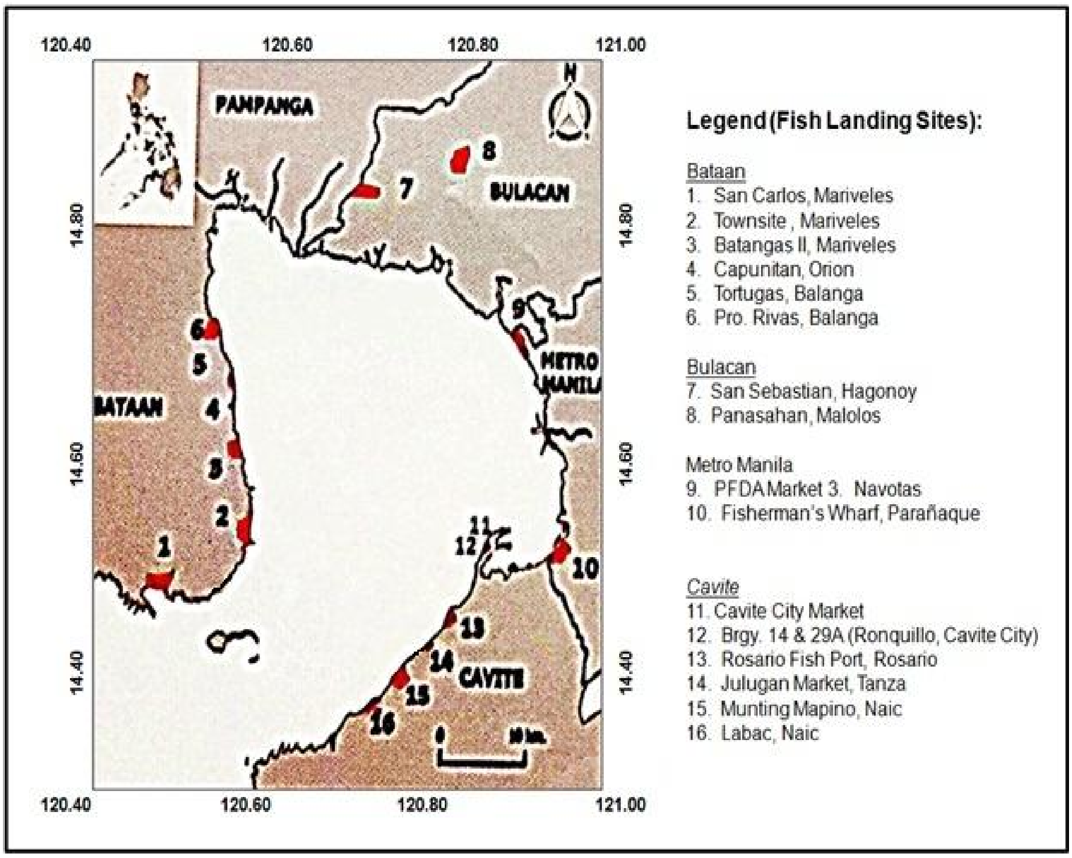


Photo Source: Internet searches

Plate 2-24 Examples of photos of some of the common demersal fish species reported/observed in Lucanin and adjacent waters (Mariveles, Bataan)

There are three (3) major fish landing sites in Mariveles located in Barangays San Carlos, Townsite and Batangas II (**Figure 2-45**). The largest fish landing site is in Barangay San Carlos located at the Mariveles town proper. All the boats that land are municipal boats and they commonly arrive at about 6:00 am to 12:00 nn. The catches are placed in "banyera" or pail and go directly to the respective consignaciones, where there are five (5), for bidding. Most of the bidders are vendors of the town market, where they sell the fish at a higher price (Anit et al., 2017). Based on informal interviews, the nearest fish landing site of the fishefolks from Lucanin is in Barangay Cabcaben.



Source: Anit et al. (2017)

Figure 2- 45 Manila Bay showing the fish landing sites

2.2.1.1.3 Potential Impacts and Mitigation

Plankton (Phytoplankton and Zooplankton)

<u>Construction Phase</u>

a) Land clearing and excavation activities within the proposed project site could result in silted run-off from the excavated areas. Since the project site experiences rainfall from May to October, the creeks and rivers like Amo River and Lucanin River in the area and eventually Manila Bay could be susceptible to siltation/sedimentation. Turbidity (levels of suspended solids) will also increase as a result of the sediment transport. Turbidity would tend to limit light penetration in the water column which is essential in photosynthesis, a vital process in phytoplankton primary production. Increased turbidity would also lead to the irritation and clogging of gills of pelagic fish larvae and juveniles (ichthyoplankton) that could lead to their eventual smothering (Hirsch *et al*., 1978). This condition would slightly increase the mortality rates among pelagic fish larvae/juveniles including other planktonic organisms. These impacts would adversely but insignificantly impact planktonic organisms temporarily.

To prevent siltation of the creeks and rivers and the bay waters, provision of temporary drainage canals with silt traps or basin will be done to intercept washed out soil particles particularly in areas of excavation. Where natural depression is available, surface run-off should be directed into it by a temporary ditch to allow settlement of suspended solid. To minimize the siltation/sedimentation and increase in turbidity, mound of soils and construction spoils should not be placed near the creek/river to avoid its movement towards the bay waters. Filling materials should be immediately transported to the fill area and compacted to avoid its transport to the bay through runoff. Regular disposal of construction spoil should be done to prevent accumulation in the site which could increase the possibility of its transport to the sea.

b) Spillage and washings of oil & grease from heavy construction equipment can produce thin film on the surface water which can reduce the rate of re-oxygenation of the creeks/rivers and nearby marine waters and consequently affect the biological life in the water.

To minimize oil & grease spillage, temporary containment canal around the perimeter of the motor pool will be constructed. The run-off laden with oil spills will be directed to an oil-water separator to remove oil from the water.\

Operation Phase

a) Sewage and wastewater will be generated from various sources, particularly the washrooms and toilets and water used for housekeeping and maintenance of other facilities, including storm water and run-off from land. This will eventually end up in the nearshore marine waters of Lucanin through the Amo River and Lucanin River. Water pollution with nitrate and pathogenic phosphate (usually fecal germs and Salmonella) is the main cause for concern in the case of poultry farming. This means that the aquatic ecosystems can be negatively affected by the presence of these pollutants (including suspended matter and detergents). It is reported by several authors that phytoplankton red tide organisms require the same nutrients (nitrogen and phosphorus) for their rapid growth, or harmful algal bloom.

Appropriate mitigating measures that could be applied to prevent this identified potential impact that might occur in the area are shown below.

a) The proponent will develop the necessary infrastructure in the area of sewage and wastewater management to make the proposed broiler farm project sustainable.
b) Liquid wastes which comprised all water used in the project during operation should be directed to a planned water treatment plant facility to ensure that coastal waters will be free from biological and bacteriological contaminants. Liquid waste must be treated before it is

release into the environment to prevent any harm or risk it may have on the environment and human health. Appropriate treatment will be employed so that the final effluent would meet the DENR water quality standards.

c) Storm water from the proposed project site should be diverted to the storm drains/canals in the area. Stormwater discharge points to be checked and inspected on a weekly basis for any sign of contamination before it will be discharged to the aquatic environment. Appropriate measures to be put in place to deal with any accidents etc. that have the potential to cause adverse environmental impact.

Abandonment Phase

a) There will be no significant impact of abandonment activities to the nearshore marine waters upon transient plankton organisms may be expected.

Soft Bottom Infaunal Benthos

No seabed disturbance is to be expected since there will be no project construction and operational activities along the coastal shore in Lucanin that will produce a negative impact on the soft bottom infaunal benthic communities in the area. In addition, the distance of the proposed poultry farm project from the beach is about 2.25 km. Therefore, no mitigation is needed.

Coral Reef, Seagrass Bed and Mangrove

There are no sensitive biological communities (coral reef, seagrass bed and mangrove) are known to occur along the coastal shore of the project site in Lucanin, only submerged rocky outcrops, some patches of seaweeds, and stands of aroma and several talisai trees on the beach. Therefore, no negative impacts are predicted and no need for mitigation of impacts.

Local Fisheries Resources

Significant impacts to marine fish capture fisheries resources are unlikely due to the distant location of their traditional and municipal fishing grounds, more than two (2) km seaward from the proposed poultry farm project site. Therefore, no need for mitigation of impacts is required.

2.2.2 Hydrology and Hydrogeology

2.2.2.1 Change in Drainage Morphology / Inducement of Flooding / Reduction in Stream Volumetric Flow

The proposed Lucanin Multi-Tier Broiler Project may have an impact on drainage morphology, induce flooding, and reduce stream volumetric flow if there are large volumes of wastewater generated by the farms.

One of the components of the proposed project is Biomax Rapid Thermophilic Digester which will be used in the management of chicken manure disposal.

The system can help reduce the amount of organic waste generated by the farm. Instead of disposing of the waste in a landfill or spreading it on nearby land, the waste can be processed in the digester, which can reduce the risk of waste runoff and pollution of nearby rivers and streams. This could potentially improve river morphology by reducing sedimentation and erosion caused by excess runoff.

Secondly, the digester can produce biogas, which can be used as a renewable energy source for the farm. If the farm can generate enough biogas, it may reduce their dependence on non-renewable energy sources, which can help mitigate the effects of climate change in the long run.

However, the use of the digester may also induce flooding and reduce the stream volumetric flow, depending on how the digester is managed. The system requires a constant supply of water to maintain the right temperature for the bacteria to operate effectively. If the farm is drawing water from nearby rivers or streams, it may reduce the volume of water available downstream, potentially leading to a reduction in stream volumetric flow.

Furthermore, if the digester system is not properly designed or maintained, it could potentially contribute to flooding. The system requires a large amount of water to operate, and if the digester tank or associated infrastructure is damaged, it could lead to a release of water and potentially cause flooding.

Overall, the use of a Biomax Rapid Thermophilic Digester in a broiler farm has both potential benefits and risks. It is important for the farm to ensure that the system is properly designed, maintained, and operated to minimize any negative impacts on the surrounding environment.

2.2.2.2 Change in Stream, Lake Water Depth

Aside from minor sedimentation that can be caused by soil erosion, the streams in and around the study area shouldn't change as a result of the proposed project. The proposed broiler farm is not close to any lakes, or any other bodies of water.

2.2.2.3 Depletion of Water Resources / Competition in Water Use

The proposed Lucanin Multi-Tier Broiler Project can have a significant impact on the depletion of water resources and competition in water use, particularly in areas where water scarcity is already a concern.

Water is essential for raising broiler chickens, as they require access to clean drinking water at all times. Additionally, water is used for cleaning and sanitizing equipment, facilities, and the birds themselves.

It can have a significant water demand, and the large-scale production of broiler chickens can put pressure on water resources in regions where water is scarce. This can lead to increased competition for water resources among different water users, including farmers, households, and industrial facilities, which can exacerbate water scarcity.

Moreover, intensive broiler farming practices, such as the use of automated watering systems and the disposal of large amounts of animal waste, can increase the risk of water pollution and contamination. This can further reduce the availability of clean water resources for other users and ecosystems.

A dedicated water supply system with efficient planning and design should be undertaken in order to ensure efficient water supply and avoid issues in water allocation with the surrounding water users.

2.2.3 Water Quality

2.2.3.1 Degradation of Coastal / Marine Quality

The scope and coverage under DAO 2016-08 for Water Quality Guidelines (WQG) states that applies to all water bodies in the country including freshwaters, ground waters, and for this project, the nearshore coastal/marine waters along the coast of Lucanin in Manila Bay. WQG shall be used for classifying water bodies. For purposes of maintaining water quality according to its intended beneficial usage applicable for this project, the following classification of water bodies shall be adopted (**Table 2- 32**).

Table 2- 32 Analytical Methodologies Employed for Water Quality Parameters

Classification	Intended Beneficial Use
Class SA	Protected Waters – Waters designated as national or local marine parks, reserves, sanctuaries, and other areas established by law (Presidential Proclamation 1801 and other existing laws), and/or declared as such by appropriate government agency, LGUs, etc. Fishery Water Class I – Suitable for shellfish harvesting for direct human consumption
Class SB	Fishery Water Class II – Waters suitable for commercial propagation of shellfish and intended as spawning for milkfish (Chanos chanos) and similar species. Tourist Zones – For ecotourism and recreational activities Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, skin diving, etc.)
Class SC	Fishery Water Class III – For the propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing Recreational Water Class II – For boating, fishing, or similar activities Marshy and/or mangrove areas declared as fish and wildlife sanctuaries
Class SD	Navigable waters

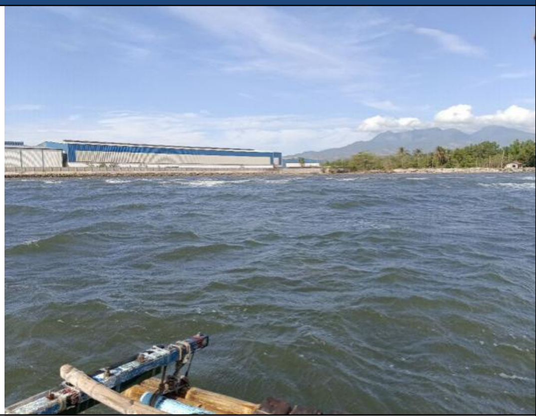
The parameters defining the WQG are categorized as primary or secondary parameters. The recommended parameters, frequency and duration of sampling of the Ambient Water Quality Monitoring is issued under EMB M.C 2008-008 along with the procedures, plans, sampling, quality assurance, and quality control.

Furthermore, last 30 June 2021, under DAO 2021-19, selected parameters were approved to update its Water Quality Guidelines (WQG) and General Effluent Standards (GES) based on the current classification for water bodies and its beneficial use, and its perceived impact to the activities in the area of the environment.

The water body is classified by the DENR to determine its most beneficial use and its water quality. The water body classification is then used as the basis in determining the water quality standard for the water body and the effluent quality standard that is allowed for discharge in the water body.

Based on DENR Administrative Order (DAO) No. 2016-08, the nearshore/coastal marine waters of Lucanin (Manila Bay) may be classified as Class SC waters because they are used for shipping/navigation, docking, industrial process, aside from recreational and municipal/sustenance fishery purposes.

Marine Water Quality Sampling Stations

STATION ID	PHOTO	DESCRIPTION OF SAMPLING STATION	GEOGRAPHICAL COORDINATES
MW-1		Sampling Date: February 15, 2023 Sampling Time:9:30 am Prevailing Wind / Tide/ Sea Condition: NE/Somewhat Rough/High Tide Depth: 2.0 meters Approx. 224 meters away from the shore	14°27'40.40" N 120°36'14.00" E
MW-2		Sampling Date: February 15, 2023 Sampling Time: 12:00 nn Prevailing Wind / Tide/ Sea Condition: NE/Somewhat Rough/High Tide Depth: 1.0 meters Approx. 171 meters away from the shore	14°28'28.33" N 120°36'18.99" E
		Sampling Date: February 15, 2023 Sampling Time: 10:10 am Prevailing Wind / Tide/ Sea Condition: NE/Rough/High Tide Depth: 10.0 meters Approx. 463 meters away from the shore	14°27'47.72" N 120°36’23.81"E

Station ID	Photo	Description of Sampling Station	Geographical Coordinates
MW-4		Sampling Date: February 15, 2023 Sampling Time: 11:30 am Prevailing Wind / Tide/ Sea Condition: NE/Rough/High Tide Depth: 6.0 meters Approx. 490 meters away from the shore	14°28'21.69"N 120°36'30.29"E

-

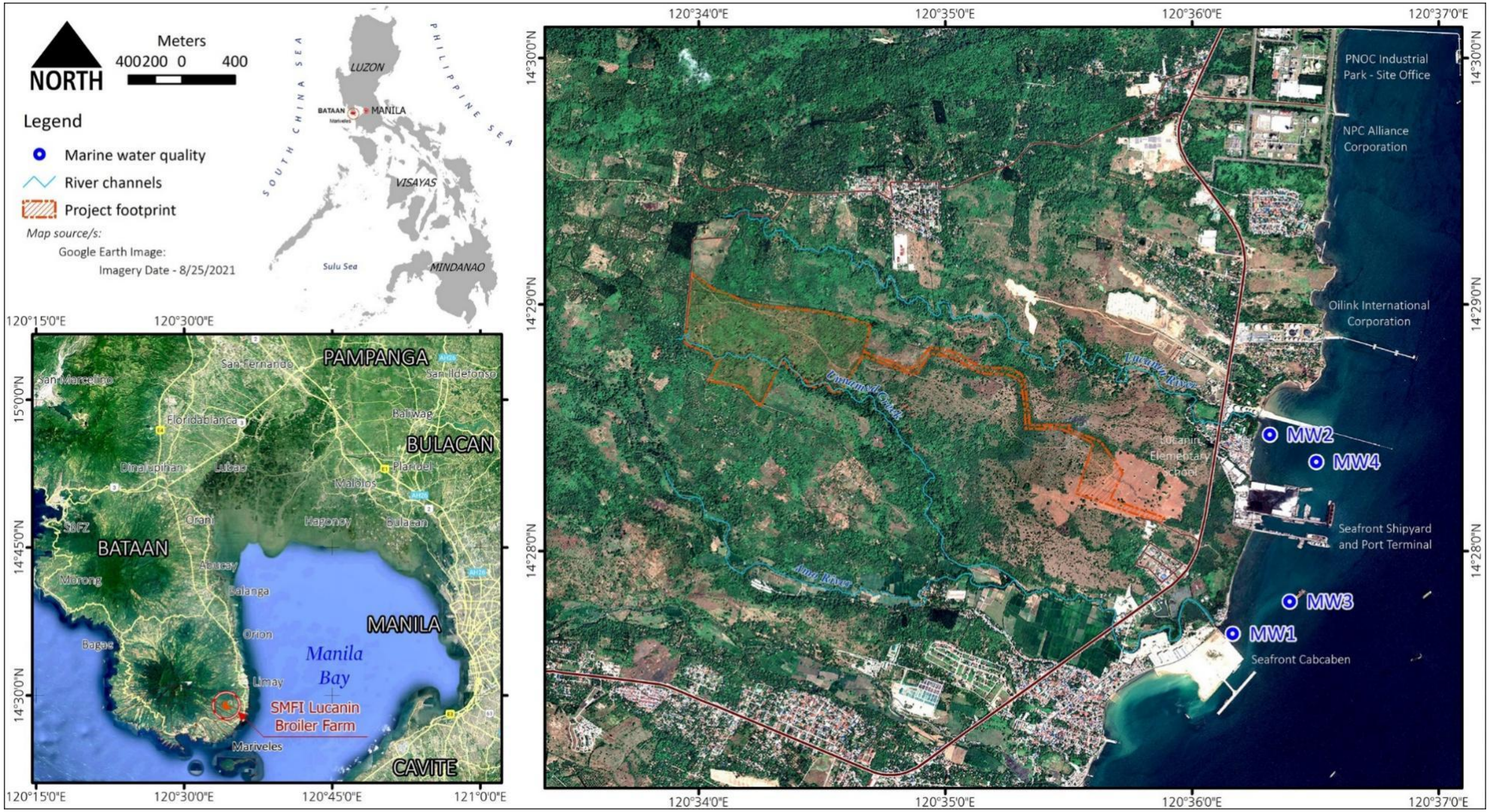


Figure 2-46 Marine Water Quality Sampling Stations

Marine Water Quality Results and Analysis

The results of the marine water quality laboratory analysis (**Annex 8)** on color, dissolved oxygen (DO), hydrogen-ion concentration (pH), total suspended solids (TSS), biochemical oxygen demand (BOD5), chemical oxygen demand (COD), chloride, nitrate, phosphate, fecal coliform, boron, fluoride, selenium, sulfate, and oil & grease are summarized in **Table 2-33** below.

Table 2-33 Results of Water Quality Analysis in All Sampling Stations

WATER QUALITY PARAMETERS	SAMPLING STATION				AVE./ RANGE	DAO 2016-08 & DAO 2021-19 WATER QUALITY GUIDELINES (CLASS SC)
	MW1	MW2	MW3	MW4		
A. Primary Parameters						
Color (TCU)	3	3	3	3	**3**	75
DO (mg/L)	7	3	4	5	**5**	**5**
pH	7.44	7.44	7.45	7.45	**7.45**	**6.5-8.5**
TSS (mg/L)	11	26	4.0	22	**16**	**80**
BOD_5 (mg/L)	1	1	1	<1	**<1-1**	**n/a**
COD (mg/L)	657	560	251	356	**456**	**n/a**
Chloride (mg/L)	19,400	24,500	23,700	19,700	**21,825**	**n/a**
Nitrate (mg/L)	<0.017	<0.017	<0.017	0.02	**<0.017-0.02**	**10**
Phosphate as P (mg/L)	<0.0064	<0.0064	<0.0064	<0.0064	**<0.0064**	**0.5**
Fecal Coliform (MPN/100mL)	<1.8	4.5	1.8	<1.8	**<1.8-4.5**	**200**
B.1 Secondary Parameters (Inorganics)						
Boron (mg/L)	5.0	**5.2**	4.9	4.8	**5.0**	**5**
Fluoride (mg/L)	0.7	1.1	0.9	0.9	**0.9**	**1.5**
Selenium (mg/L)	<0.008	<0.008	<0.008	<0.008	**<0.008**	**0.1**
Sulfate (mg/L)	**1,370**	**1,330**	**1,700**	**980**	**1,345**	**275**
B.2 Secondary Parameters (Organics)						
Oil & Grease (mg/L)	1.4	1.3	1.4	1.3	**1.4**	**3**

Legend: TCU = True Color Unit; MPN/100mL = Most Probable Number per 100 Milliliter; mg/L = Milligram per liter; (n/a) = not applicable; Class SC = areas used for the propagation and growth of fish and other aquatic resources and intended for commercial and sustenance fishing; for boating and fishing
*Note:- **Red** font values have exceeded their respective DENR WQ standards for Class SC waters*

Based on the result of marine quality sampling, the true color levels of the water samples collected in this survey were at a uniform level of three (3) TCU in all marine stations; however, all these color values are way below the maximum permissible limit of 75 TCU in Class SC water.

The DO levels in all stations ranged widely from 3 to 7 mg/L (average of 5 mg/L). However, lower DO levels of 3 and 4 mg/L were observed at Stations MW2 and MW3, respectively which are below the DENR minimum limit of 5 mg/L for DO in Class SC water.

All the four (4) marine stations have pH levels which ranged from 7.44 to 7.45 (average of 7.45) which are well within the DAO 2016-08 water quality guideline for pH in Class SC water of 6.5 to 8.5.

The TSS values obtained in all the four (4) marine stations ranged widely from 4 to 26 mg/L (average of 16 mg/L) which are way below the prescribed DENR maximum allowable limit of up to 80 mg/L for this parameter.

The new DAO 2016-08 has not set definite water quality guidelines for this parameter in marine waters Class SA, SB, SC and SD. The BOD5 values obtained during this recent survey in all marine stations showed very low levels ranging from <1 to 1 mg/L.

The COD values obtained in all the four (4) marine stations ranged from 251 to 657 mg/L with an average of 456 mg/L. However, COD values cannot be directly compared to a set of prescribed limits in the absence of COD standards for seawater or freshwater bodies.

Chloride concentrations as measured in this survey varied from 19,400 to 24,500 mg/L with an average of 21,825 mg/L. However, these chloride levels cannot be directly compared to a set of prescribed maximum allowable limits in the absence of DAO 2016-08 water quality guideline for this parameter in marine/coastal waters.

Nitrate values obtained are very low in all marine stations which ranged from not detectable or below detection limit at <0.017 mg/L to detectable level of 0.02 mg/L which are way below the DAO 2016-08 water quality guidelines which prescribed a maximum allowable concentration of 10 mg/L for this parameter in Class SC coastal/marine water. Rain water may contain concentration of 0.2 mg/L (Canadian Council of Ministers of the Environment, 1995 as cited by Woodward-Clyde, 1996).

Phosphate values obtained in this survey are very low in all marine stations (not detectable or below detection limit at <0.0064 mg/L). All these PO4 levels are way below the maximum allowable concentration of 0.5 mg/L for this parameter for Class SC water.

The level of fecal coliform which is mostly associated with human and animal waste was very low in all stations (not detectable or below detection limit at <1.8 MPN/100mL to 4.5 MPN/100mL).All the detectable fecal coliform levels obtained are way below the maximum allowable concentration of 200 MPN/100mL for Class SC water.

Boron values in all stations in this survey ranged from 4.9 to 5.2 mg/L with an average of 5.0 mg/L. The highest level (5.2 mg/L) was recorded at Station MW2 which slightly exceeded the maximum allowable concentration of 5 mg/L for Class SC water. The Boron level of 5.2 mg/L at Station MW2 exceeded the DENR regulatory limit of 5 mg/L by only 0.2 mg/L. The possible caused is also unknown. Seawater contains approximately 4-5 ppm (mg/L) boron. Anthropogenic sources of boron in the ocean include industrial and agricultural activities. The burning of fossil fuels releases boron into the atmosphere, which is deposited into the ocean through precipitation. Agriculture also contributes to the boron levels in the ocean, as boron is present in larger amounts in fertilizers and pesticides. These fertilizers and pesticides can easily leach into nearby water bodies such as rivers, lakes and the oceans. In marine ecology, boron plays an important role in primary productivity. It is involved in the process of photosynthesis in phytoplankton, which is the base of marine life.

Fluoride levels in all stations during this survey ranged from 0.7 to 1.1 mg/L with an average of 0.9 mg/L, which are below the DENR maximum allowable concentration of 1.5 mg/L for Class SC water.

Selenium in this survey was found not detected or below detection limit of <0.008 mg/L in all stations. The DENR maximum permissible level for this parameter for Class SC water is 0.1 mg/L.

The levels of sulfates in all the four (4) marine stations during this recent survey ranged from 980 to 1,700 mg/L with an average of 1,345 mg/L, which all exceeded the DENR regulatory limit of 275 mg/L for this parameter for Class SC water. The possible cause of high levels of suphates in the four sampling stations is unknown. However, sulfate is one of the major ions or compositions of seawater (mg/L). Typical seawater contains about 2, 649 mg/L. In the Arabian Gulf, the sulfate content of seawater is about 3,280 mg/L. Results of a water quality monitoring surveys near the mouth of Subic Bay on the levels of sulfate in the three (3) marine stations in September 2021 (606-671 mg/L), November 2020 (917-947 mg/L), October 2021 (2,740-3,050 mg/L), and October 2022 (2,180- 2,280 mg/L) conducted by the Consultant showed all sulfate levels analyzed exceeded the DENR regulatory limit. Sulfate enters the ocean from river runoff.

Oil & grease levels in all stations ranged from 1.3 to 1.4 mg/L (average of 1.4 mg/L).However, these values are below the prescribed maximum allowable concentration of 3.0 mg/L for this parameter for Class SC water.

2.2.3.2 Degradation of Groundwater Quality

The application of broiler litter and other agrochemicals can lead to changes in the soil permeability, which can affect the ability of the soil to absorb and retain water. This can lead to changes in the soil moisture regime and potentially affect the groundwater recharge rates.

If the digester is operated properly, it can potentially reduce the risk of groundwater contamination from the farm's organic waste. This is because the system can help to break down the waste and convert it into biogas and a nutrient-rich fertilizer that can be used on nearby crops. By processing the waste in the digester, the farm can potentially reduce the risk of nutrient pollution and other contaminants entering the groundwater system.

Furthermore, the system can potentially reduce the volume of waste that is disposed of in nearby landfills or spread on nearby land. This can help to reduce the risk of leachate from the landfill or nutrient runoff from the land impacting groundwater quality.

In addition to the use of the digester, proper management practices such as conservation tillage, erosion control measures, and nutrient management planning can help maintain the soil structure and reduce the risk of soil compaction and permeability changes.

For efficient management and monitoring, it is crucial to identify the current features of the groundwater quality. Water sampling was done in order to establish baseline information on the state of the groundwater within the study area.

Overall, the effect of using a Biomax Rapid Thermophilic Digester on groundwater quality depends on a variety of factors, including the design, operation, and maintenance of the system, as well as the surrounding environment and groundwater system. It is important for the farm to ensure that the system is operated in a way that minimizes any negative impacts on groundwater quality.

2.2.3.2.1 Groundwater Sampling

Two (2) groundwater sampling stations were established for the study. Samples were taken from (a) deep well and (b) spring source. Samples were collected, stored in ice chests, and transported to CRL Laboratory in Clark, Pampanga. The sampling protocol employed in the collection of water samples was based on the Ambient Water Quality Monitoring Manual of 2008 (DENR – EMB 2008), while the analytical methods were based on the Standard Methods for the Examination of Water and Wastewater (APHA, 2017).

The groundwater sampling details are show in **Figure 2-47** and **Table 2-34**.

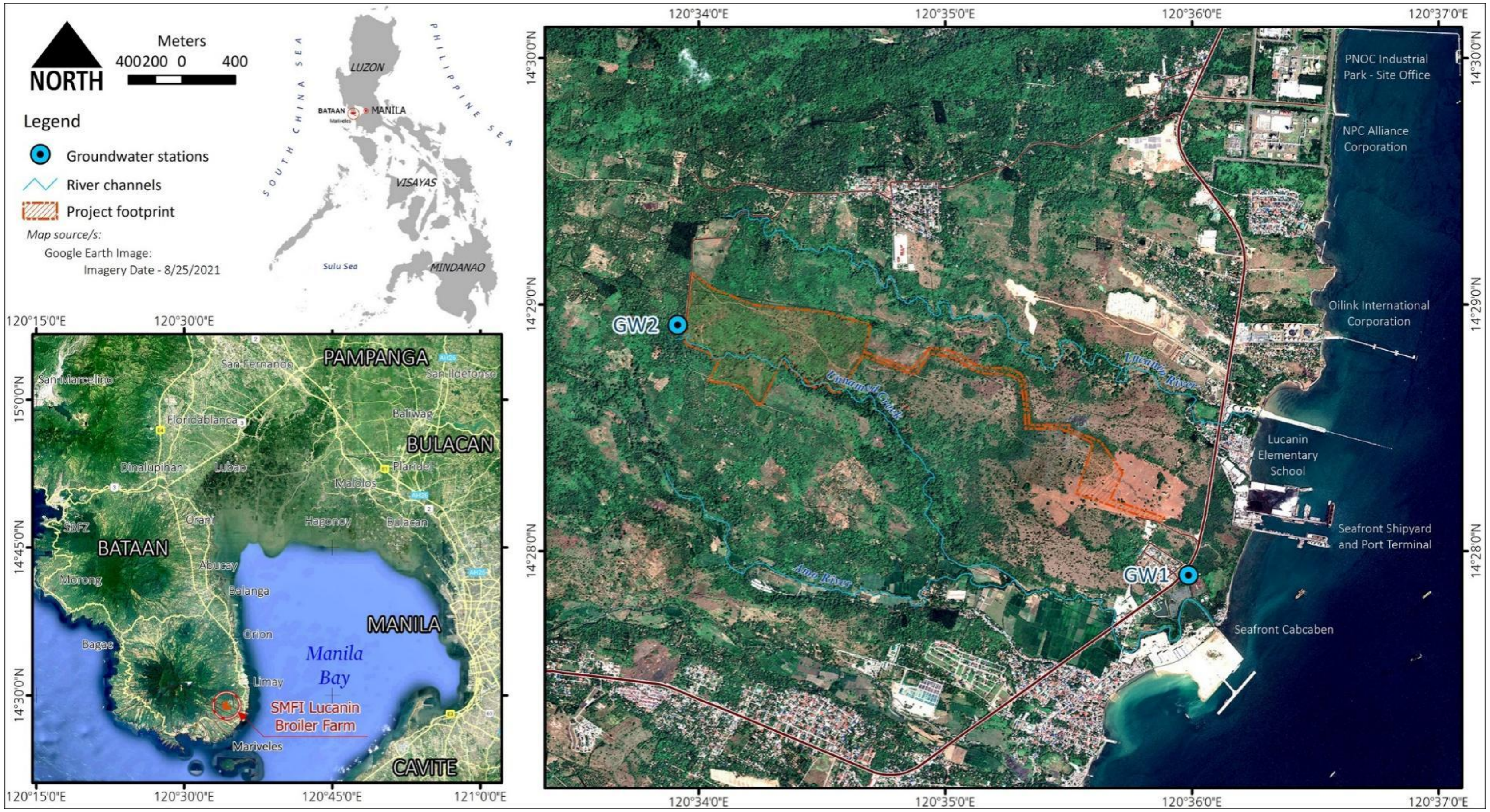


Figure 2- 47 Groundwater Sampling Stations

Table 2- 34 Groundwater Quality Sampling Stations

Station	Photo	Name and Location of Water Body	Description of Sampling Station	Geographical Coordinates
GW-1	 	Source of Water: Deepwell Sampling Location: Villa Imperial Resort at Barangay Lucanin	Sampling Date: Feb 09, 2023 Sampling Time: 1230H Weather during sampling: Sunny Brief description of the sampling station: Tap water being used for domestic purposes and drinking. Water is clear and odorless	14°27'54.14"N 120°35'59.18"E
GW-2		Source of Water: Water is being tapped through a upland spring Sampling Location: Residential house at the Lucanin -Alion Barangay road	Sampling Date: Feb 09, 2023 Sampling Time: 1000H Weather during sampling: Sunny Brief description of the sampling station Tap water being used for domestic purposes and cleaning of swine housing. Water is clear and odorless	14°28'55.03"N 120°33'54.91"E

STATION	PHOTO	NAME AND LOCATION OF WATER BODY	DESCRIPTION OF SAMPLING STATION	GEOGRAPHICAL COORDINATES
				

2.2.3.3 Groundwater Quality Results and Analysis

The samples were brought to CRL Laboratory in Clark, Pampanga for analysis. Since the groundwater sources sampled from were being used for drinking, the results were evaluated against the Philippine National Standards for Drinking Water (PNSDW) 2017, as well as DAO 2016-08 AND 2021-19 Class A.

The laboratory results are shown in **Table 2-35** The threshold values for evaluation are also shown. The official results are attached in **Annex 8.**

Table 2-35 Groundwater Quality Results

PARAMETERS	UNIT	PNSDW 2017	DAO 2016-08 & 2021 – 19 CLASS A	GW 1	GW 2
Temperature	°C	-	26 to 30	25	25
pH		6.5 to 8.5	6.5 to 8.5	6.9	6.3
Total Hardness	mg/L as CaCO3	300	-	103	31
Turbidity	NTU	5	-	0.65	0.80
TSS	mg/L	-	50	142	60
Chloride	mg/L	250	250	4.1	3.1
Hexavalent Chromium	mg/L	-	0.01	<0.004	<0.004
Arsenic	mg/L	0.01	0.01	<0.005	<0.005
Cadmium	mg/L	0.003	0.003	<0.001	<0.001
Lead	mg/L	0.01	0.01	<0.005	<0.005
Total Coliform	MPN/100 ml	<1.1	-	>8.0	>8.0
Thermotolerant Coliform / E.Coli	MPN/100 ml	<1.1	-	<1.1	>8.0

***Red font** means deviation from the guideline value*

Results show that Station GW 1 and GW2 was slightly below the minimum temperature mandated by DAO Class A. Its TSS value is also above the limit for both PNSDW and DAO. High TSS levels in groundwater can be caused by a variety of factors, including natural processes such as erosion and weathering of rocks and soils. High levels of rainfall can also increase TSS levels in groundwater. Anthropogenic activities such as construction, mining, and agriculture can also increase TSS levels in groundwater. These activities can lead to soil erosion, which can cause sediment to enter the groundwater.

The pH level of groundwater can be influenced by a variety of natural and human factors. These can fluctuate due to a variety of influences. It's essential to note that the pH level of 6.3 is just 3% below the threshold value of 6.5. The slightly acidic property of the sample may be attributed to the sampling station being at a residential area, where decaying organic matter in the soil or subsurface can produce organic acids, which can lower the pH of groundwater as they leach into it. Further, GW2 being at a higher elevation, may indicate that the water table may be closer to the surface, being more vulnerable to pollution factors such as human activities and agricultural runoff.

Another notable parameter reading beyond the acceptable limits is that for the total coliform level. Both sampling stations registered readings of >8.0 MPN/100 ml. A high total coliform reading in groundwater can indicate potential contamination and water quality issues. Common causes include contaminated surface water, which is consistent with the results for the surface water samples, wherein surface water can seep into groundwater sources, carrying with it coliform bacteria from sources like sewage, septic tanks, or agricultural runoff, leading to elevated coliform readings. High coliform count can also be caused by poorly constructed or improperly maintained wells can allow surface contaminants to infiltrate groundwater, increasing coliform levels.

2.2.4 Degradation of Surface Water Quality

SMFI Lucanin Multi-Tier Broiler Project can have a significant impact on the quality of surface water in the surrounding area. Surface water quality refers to the physical, chemical, and biological properties of water bodies such as rivers, lakes, and streams. In the case of the proposed Lucanin Multi-Tier Broiler Project , it may affect the quality of water in the Lucanin and Amo Rivers.

If the digester is properly run, it may lessen the quantity of organic waste the farm produces, which may lessen the danger of water pollution. The potential of nutrient contamination and flow into neighboring rivers exists if the farm disposes of organic waste in a landfill or spreads it on nearby land.

Nutrient pollution can result in toxic algal blooms, oxygen depletion, and other detrimental effects on surface water quality. The farm may lessen these dangers by digesting the waste in the digester.

Additionally, if the digester is run properly, it may be able to lower the level of contamination and other dangerous elements in the waste. Numerous kinds of bacteria, viruses, and parasites that may potentially cause waterborne illnesses if they get into surrounding surface waters can be eliminated by the system's high temperatures.

It is important to establish the current characteristics of the rivers' water quality for effective management and monitoring. This was done through water sampling in order to establish the baseline data and condition of the Lucanin and Amo Rivers.

2.2.4.1 Surface Water Sampling

A total of four (4) samples were collected by grab sampling from Lucanin River and Amo River. Upon collected, the samples were stored in an ice chest and transported to the laboratory for analysis.

Similar to the groundwater sampling, the specifications used in the activity was based on the Standard Methods of Examination of Water and Wastewater (APHA, 2017) and Ambient Water Quality Monitoring Manual of 2008 of the DENR-EMB.

Figure 2-48 and **Table 2-36** shows the details of the surface water quality sampling activities.

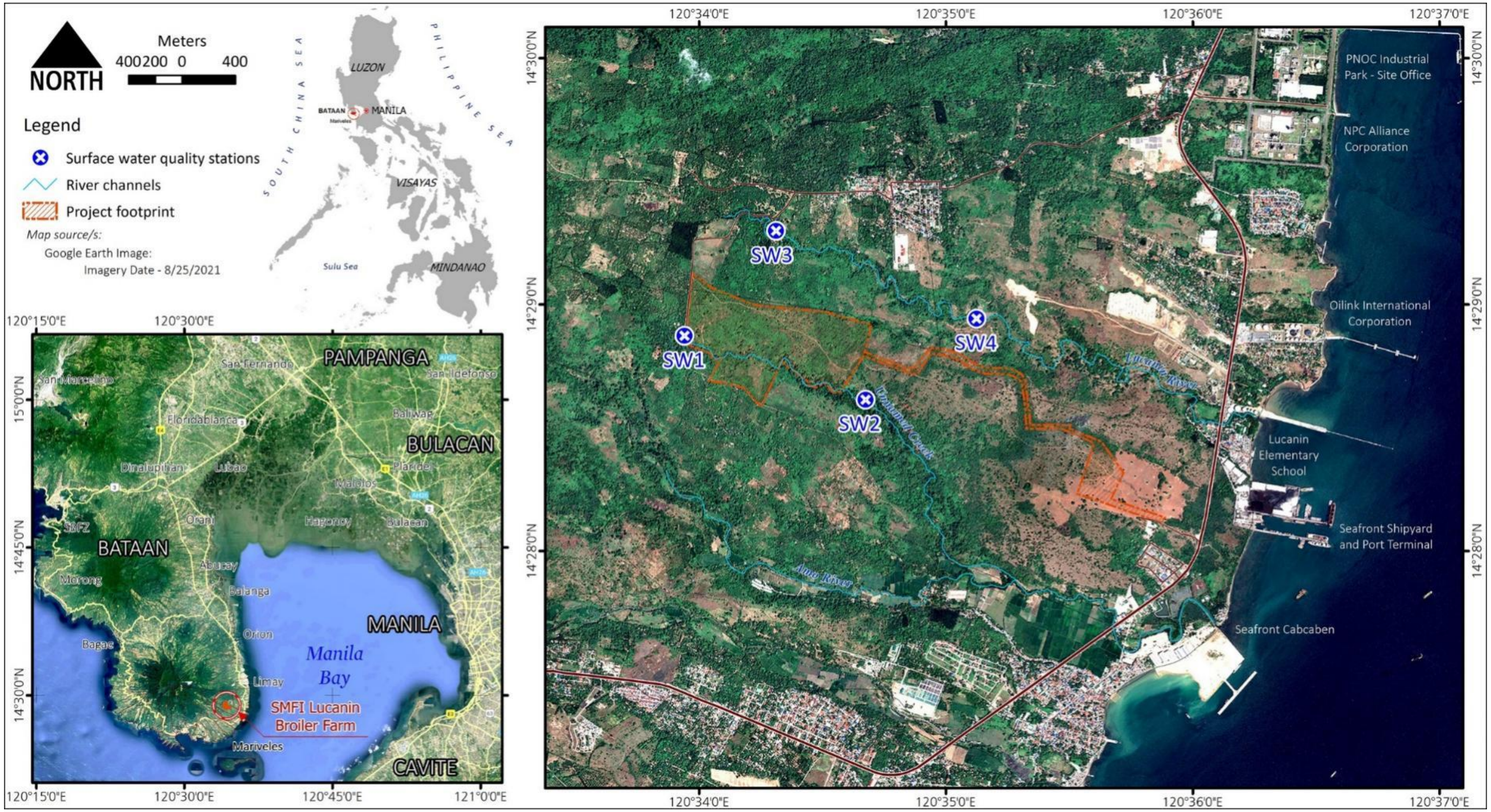


Figure 2-48 Surface Water Quality Sampling Points

Table 2- 36 Surface Water Sampling Activities

STATION	PHOTO	NAME AND LOCATION OF WATER BODY	DESCRIPTION OF SAMPLING STATION	GEOGRAPHICAL COORDINATES
SW-1	 	**Source of Water**: Surface water Creek tributary to Amo river (Upstream location from site) **Sampling Location:** Sampling conducted near the bridge of Lucanin - Alion Barangay road	Sampling Date: Feb 09, 2023 Sampling Time: 0950H Weather during sampling: Sunny Brief description of the sampling station: River flow is stagnant with some plastic waste and animal feces. Water is greyish and with some foul smell	14°28'52.38"N 120°33'56.40"E

STATION	PHOTO	NAME AND LOCATION OF WATER BODY	DESCRIPTION OF SAMPLING STATION	GEOGRAPHICAL COORDINATES
SW-2	 	**Source of Water:** Surface water from creek tributary to Amo river (Downstream location from site) **Sampling Location:** Downhill area south of the site, Barangay Lucanin	Sampling Date: Feb 09, 2023 Sampling Time: 1315H Weather during sampling: Sunny Brief description of the sampling station Surface water is clear, and area is not commonly accessed by people	14°28'36.84"N 120°34'40.39"E
SW-3		**Source of Water:** Surface water sampled from Lucanin river **Sampling Location:** Lucanin River (upstream location), Barangay Alion, north of the site	Sampling Date: Feb 09, 2023 Sampling Time: 1025H Weather during sampling: Sunny Brief description of the sampling station: The area is being utilized as laundry	14°29'17.92"N 120°34'18.67"E

STATION	PHOTO	NAME AND LOCATION OF WATER BODY	DESCRIPTION OF SAMPLING STATION	GEOGRAPHICAL COORDINATES
			and shower area. Plastic waste such as laundry sachet packs and shampoo were observed. Water is clear and odorless	
SW-4		Source of Water: Surface water sampled from Lucanin river Sampling Location: Lucanin River (downstream location), Barangay Alion	Sampling Date: Feb 09, 2023 Sampling Time: 1140H Weather during sampling: Sunny Brief description of the sampling station The area is being utilized as laundry	14°28'56.56"N 120°35'7.41"E

STATION	PHOTO	NAME AND LOCATION OF WATER BODY	DESCRIPTION OF SAMPLING STATION	GEOGRAPHICAL COORDINATES
			and shower area. Some residential houses nearby. Water is clear and odorless	

2.2.4.2 Surface Water Quality Results and Analysis

The water quality of the rivers near the project site was assessed based on DAO 2016-08 and DAO 2021-19 for Class C.

DAO 2016-08 prescribes water quality criteria corresponding to the beneficial use of the water source. The DAO 2021-19 contains the updated Water Quality Guidelines (WQG) and General Effluent Standards (GES).

FRESH WATER CLASSIFICATION	BENEFICIAL USE
Class AA	Public Water Supply Class I -uninhabited catchments, protected areas -only requires disinfection
Class A	Public Water Supply Class II -for sources requiring complete treatment (coagulation, sedimentation, filtration, and disinfection)
Class B	Recreational Water Class I -primary contact recreation for tourism purposes (bathing, swimming, diving, etc.)
Class C	Fishery Water For the propagation and growth of fish and other aquatic resourcesRecreational Water Class II(e.g., boating, etc.).For agriculture, irrigation, livestock, watering, etc.

Table 2-37 Surface Water Quality Results

PARAMETERS	UNIT	DAO 2016-08 & 2021 – 19 CLASS B	SW 1	SW 2	SW 3	SW 4
Fecal Coliform	mpn/100 ml	100	540,000	130	3,500	460
pH		6.5 to 9	6.4	7.7	6.3	7.0
Temperature	°C	26 to 30	25	25	25	25
Color	CU	50	10	8	3	15
Turbidity		5 (PNSDW 2017)	27	6.7	10	18
DO	mg/L	Minimum of 5.0	<2	8	6	9
BOD	mg/L	5	7	<1	<1	<1
COD	mg/L	-	45	31	29	14
Surfactants (MBAS)	mg/L	0.3	0.3	0.1	0.1	<0.02
TSS	mg/L	65	12	3.0	<2.38	3.0
Oil and Grease	mg/L	1	1.4	1.4	1.4	1.4
Chloride	mg/L	250	4.6	4.6	5.1	4.6
Sulfate	mg/L	250	<5.0	<5.0	<5.0	<5.0
Hexavalent Chromium	mg/L	0.01	<0.004	<0.004	<0.004	<0.004
Nitrate	mg/L	7	0.4	0.4	0.7	0.5
Phosphate	mg/L	0.025	0.8	0.05	0.02	0.03

***Red font** means deviation from the guideline value*

Human influence such as bathing and washing of clothes may have resulted to increased values of phosphate and BOD. The highly elevated fecal coliform count for stations 1, 3 and 4 may also be due to animal waste directly polluting the rivers. Station 2 has a lower value since it is not usually accessed by animals and inhabitants.

DAO 2016 -06 and 2021-19 does not have a threshold parameter for Turbidity. The PNSDW 2017 however, prescribes as acceptable value of 5. All stations registered a value higher than this threshold. High turbidity readings in rivers indicate that the water is cloudy or murky due to the presence of suspended particles. Several factors can cause this, such as erosion, or stormwater runoff. Soil erosion from agricultural fields, or deforested areas can introduce sediments into the river, increasing turbidity. Rainfall events can also wash debris, litter, and contaminants from roads and urban surfaces into the river, elevating turbidity levels.

A DO reading of < 2 mg/L can be attributed to the fact that the sampling site is a stagnant part of the river where some plastic waste and animal feces were noted. The water was also observed to be greyish and with some foul smell.

A dissolved oxygen (DO) reading below 2 mg/L for Station 1 indicates poor water quality and can result from various factors. Pollution from nearby agricultural, and sewage sources, as well as excessive nutrient runoff, can lead to increased microbial activity and oxygen consumption. Natural factors like high temperatures and stagnant water, as well as human activities such as bathing and washing clothes, can also contribute to low DO levels, negatively impacting aquatic ecosystems.

A reading of 1.4 mg/L (milligrams per liter) for oil and grease suggests the presence of oil and grease pollution in the water, although it is not an extremely high concentration. Agricultural runoff can introduce oil and grease into rivers when farm equipment and machinery leak oil or when petroleum-based products are used in farming operations. Stormwater runoff can also carry oil and grease from roads, and other surfaces into rivers. This runoff may contain petroleum-based products like motor oil, which contribute to oil and grease pollution. The absence of sewage lines, treatment plants and septic systems in the nearby residential areas can cause release small amounts of oil and grease directly into rivers.

Increased readings for phosphate in the sampled rivers indicates the presence of phosphorus compounds in the water. Farms located upstream of the sampling points may use phosphate-based fertilizers that can wash into rivers through runoff. Farming practices and improper fertilization techniques can contribute to higher phosphate levels in rivers. Runoff from livestock operations near the sampling stations can contain phosphates, especially if manure management practices are inadequate.

2.3 PEOPLE

This section describes the secondary data on demographic, socio-economic conditions, cultural heritage, public health and sanitation, transportation and traffic of the host municipality and barangays. It also evaluates the potential impacts of the Project on the social, economic and cultural environment, and provides measures for management and mitigation of these possible impacts..

2.3.1 Methodology

Information Education and Communication (IEC) Campaign

The main objective of the IEC is to discuss the project components to the affected communities and gather the issues and concerns of stakeholders During the open forum, it covered the perception, knowledge to the project and willingness to accept the project. Also, the sentiments of the representative were gathered to include in the report and for the information of the Proponent.

Review of Secondary data

Available secondary data, including the Municipality of Mariveles Comprehensive Land Use Plan (CLUP) and Philippine Statistics Authority (PSA) were collected and reviewed thoroughly. Error! Reference source not found. shows the methodologies used for various People module sections.

Table 2-38 Methodologies for Various People Module Sections

STUDY	METHODOLOGY	SOURCE OF INFORMATION
Socio-economic profiling of the host municipality and barangays	• Review of secondary data, reports, relevant studies and other information	• CLUP • Government website (e.g. PSA)
Ethnography and cultural heritage	• Review of secondary data, reports, relevant studies and other information	• Government agencies and website
Perception	Information Education and Communication (IEC) Campaign	• Affected Barangays
Public Health and Sanitation	• Review of secondary data	• CLUP
Traffic impact assessment	• Review of secondary data	• CLUP

2.3.2 Displacement of settlers

Demography

The Municipality of Mariveles is a cove in the southernmost area of Bataan Peninsula. It is adjacent by Manila Bay in the east, the West Philippine Sea in the west, the Municipality of Limay in the northeast, the Municipality of Bagac in the northwest, south by the North channel which separate the town from the Corregidor Island..

Mariveles is a first-class municipality as presented in **Table 2-39** with a total land area of 15,920 hectares or approximately 12% of Bataan Province total land area. It has 18 barangays parted the total land area wherein Barangay Biaan is the largest with 6,004.00 hectares or 37.71% of Mariveles and Barangay San Carlos is the smallest with 2.19 hectares or 0.0013%. As to the impacted barangays, Barangay Townsite has 380.43 hectares or 2.39% of Mariveles , Barangay Lucanin by 300 hectares or 1.88% of Mariveles and 651.78 Ha or 4.09% for Barangay Alion. Barangay Townsite and Lucanin were classified as coastal barangays with ten others and Baranhay Alion as upland. The population density of Mariveles is 9.41 ha/ person, and the affected barangays of Brgy. Lucanin, Townsite and Alion are 23.96 ha/ person, 18.93 ha/ person and 5.20 ha/ person respectively.

Based on the 2020 data of Philippine Statistics Authority, Mariveles is the most populous municipality with 149,897 total population or 17.56% of Bataan Province. The project-affected barangays, Townsite , Lucanin and Alion have a combined population of 17,781 or 11.86% of Mariveles. Barangay Townsite's 2020 population increments to 7,203 from 6,880 in 2015 or 4.69% growth rate while Barangay Lucanin's 2020 population increases to 7,189 from 5,169 in 2015 In terms of population change and Barangay Alion's 2020 population increases to 3,389 from 3.264. Brgy. Lucanin has the second population growth rate in the municipality with 39.08%.

According to the 2015 Census, the age group with highest population in the Municipality of Mariveles is 20-64 with 87,496. On the other hand, the age group with the lowest population is 65 and above with 4,152 individuals. 20-64 age group are the economically active population who belongs to the labor force while 65 and above are the old dependents and categorize as the senior citizens. As to the project-affected barangays, the age group of 20-64 in Lucanin has the greatest percentage with 56% while 65 and above have the lowest with 3%. On the other hand, Townsite's highest population group is 20-64 with 3,831 or 56% while the lowest is 65 and above with 275 individuals or 4%

In the 2014 Community Based Monitoring System (CBMS) tool for poverty mapping conducted by the province of Bataan. Mariveles population in terms of sex is almost equal. There are 61,611 males or 49.2% and 63,566 females or 50.8%

Table 2- 39 Demography of the Municipality of Mariveles and the Project-Affected Barangays

KEY FEATURES	MARIVELES	BARANGAY LUCANIN	BARANGAY TOWNSITE	BARANGAY ALION
Population (2020)	149,879	7,189	7,203	3,389
Land Area (ha) 2020	15,920.00	300.00	380.43	651.78
Population density (person/ha)	9.41	23.96	18.93	5.20
Annual Population Growth Rate (2015 vs 2020)	17.52	39.08	4.69	3.83
Number of Households	-	-	-	-
Household Size	-	-	-	-
Age (2015)				
0-19	49,723	2,122	2,774	-
20-64	73,661	2,921	3,831	-
65 and above	4,152	136	275	-
-Gender (2014)				
Male	61,611	-	-	-
Female	63,566	-	-	-

Note: - No data
Source: CLUP of Mariveles, 2017-2026, PSA 2020

2.3.3 In-migration proliferation on informal settlers

The project will induce in-migration of labor. Skilled workers from neighboring towns and communities will be moving into the host barangays in search for jobs. Beyond direct employment, there will also be a wide range of economic opportunities that may be associated with the Project and draw people to the area.

In addition to influx of skilled workers as project employees, in-migration to the Brgy. Lucanin and Townsite and Alion could include:

- Immediate and extended families of laborers from outside the Project area;
- Returning family, extended family members and former residents seeking direct employment, improved living conditions or other economic opportunities;
- Potential providers of goods and services to the Project;
- Potential providers of goods and services to the local population;
- Business entrepreneurs seeking new business opportunities; and
- Opportunistic unskilled or semi-skilled people seeking direct, indirect or entrepreneurial opportunities.

While there will be economic opportunities created as a result of the Project, the influx of population can also result to significant environmental, economic and social impacts to the project area. These include diminishing of social cohesiveness and traditional mechanisms of social control in host communities. Introduction of illegal informal communities may bring about new diseases to the host barangays will also be likely to happen.

The following measures will be established to minimize the potential impacts associated with in-migration:

- Develop a robust "Local First" hiring policy to supply the manpower requirements of the Project. The policy will be clear and precise and contains well-defined employment policy and transparent procedures to clarify what processes for employment will be in the Project, what opportunities are available, and what minimum skills will be required;
- The policy shall also be published in local dialect of the host barangays and in strategic locations such as barangay halls, municipal halls and public parks;
- The employment opportunity strategy will be developed in conjunction with the worker accommodation strategy to limit in-migration and relocation of construction workers;
- The local government unit (LGU) through the Public Employment Services Office (PESO) and will handle in-migration so as to ensure employment strategies will be consistent to the long-term development plans of the LGU; and
- Strengthen value-formation among current residents of host barangays through seminars and other traditional forms of meetings.

2.3.4 Cultural/Lifestyle change

While there is no identified indigenous peoples' group in the proposed Lucanin Multi-Tier Broiler Project that may be threatened by the Project, residents of the host barangays will likely shift to a new lifestyle due to introduction of new technology and the interaction with migrant workers brought about by the Project.

Adverse impacts that are likely to occur include local cohesion may be affected because of the presence of newcomers in search for work introducing new lifestyle in the community and introduction of new forms of entertainment (e.g. videoke and night clubs) that might affect traditional family and community life.

Economic zones are typically created to facilitate rapid economic growth by leveraging tax incentives to attract foreign investment and spark technological advancement.

The opportunity to host a Project with superior technology will also attract local and foreign guests to visit the area resulting to increase in morale and pride of the residents in the impact barangays.

In close coordination with the LGU, protocols and guidelines for work behavior among project employees and contractor agencies will be provided and conducted especially in host barangays. It will also conduct orientations and other culturally appropriate forms of meeting to discuss community values of the host barangays.

Impacts on physical cultural resource

An assessment of cultural heritage sites in the Municipality of Mariveles was conducted through a thorough review of secondary data including the list of declared historic sites and structures installed with historical markings by National Historical Commission of the Philippines (NHCP). The assessment was able to identify several historical heritage sites in the general area including Historical Marker in Mariveles Municipal Hall, World War II Death March Memorial Shrine and Historical Marker in Cabcaben Mariveles,Bataan. All these historical heritage sites are relatively far from the Project footprint (**Table 2-40**).

Table 2-40 Identified Cultural Heritage Sites and Their Distance from the Proposed Lucanin Multi-Tier Broiler Project Project

CULTURAL HERITAGE SITE	CLASSIFICATION/ CATEGORY	LUCANIN MULTI-TIER BROILER PROJECT (KM)
Historical Marker in Mariveles Municipal Hall	Sites/Events	9.80
World War II Death March Memorial Shrine	Sites/Events	10.18
Cabcaben Mariveles,Bataan	Sites/Events	1.34

Therefore, the construction of the Lucanin Multi-Tier Broiler Project and its eventual operations will not cause any adverse impacts on cultural heritage sites. Other components of cultural heritage including material culture and folklore will also not be affected by any activities. Nonetheless, a chance find procedure is proposed in case artifacts and fossils may accidentally be found while excavating the Project area during the construction phase (**Table 2-41**).

Table 2-41 Chance Find Protocol

PROBABLE FINDS	MITIGATING MEASURES	PROTOCOL	AGENCY CONCERNED
Fossils and/or artifacts	• Keep the site intact and make a contextualized description of the discovery • Carefully gather and describe the finds as well as the area in which they were discovered (National Museum authorities	• Inform the National Museum Personnel with the initial determination of the finds • Bring the discovered “finds” to the National Museum so the personnel in there could personally	National Museum

PROBABLE FINDS	MITIGATING MEASURES	PROTOCOL	AGENCY CONCERNED
	must be given enough time to determine the gravity of its significance) • Preserve the site, and if possible, mean should be sought to prevent further damage until such time that the area has been properly evaluated	examine and transmit the finding to the main office, which shall make the final determination based on previous description and further advice the company on the next procedure. • Advise the National Museum about the find/ site. Request for field evaluation.	
Burial site	• Leave the area undisturbed and make an estimate of the possible range wherein burial practice is feasible. If fossils have been exposed, carefully collect them (they are brittle when exposed) but avoid as much as skin contact as possible. The specimen might be contaminated for later dating. • Preserve the site and take appropriate measures to prevent further damage to the area.	• Inform the National Museum of the site and request for field evaluation.	National Museum

2.3.5 Threat to delivery of basic services/resource competition

Influx of migrant workers, if left unmanaged, will drive many social changes in project-affected communities. Migrant workers along with their family members and other migrants seeking business and entrepreneurial opportunities may compete for local resources such as water, food supply, wood and building materials, and local health and welfare services. Existing public services in the area may be stretched due to increase in the population thus delivery of these services may become inefficient.

In addition to mitigating measures to minimize the impacts on in-migration of workers, additional measures will be provided to address impacts on basic services delivery and resource competition:

- Provide accommodation for construction workers; however, since most of the workers are residents of the area, massive accommodation structure is not required.
- Support natural resource management and environmental protection programs implemented and develop plans to manage potential increased competition for water, food and other essential supplies that are available in the project-affected communities;
- Augment social services currently provided by the LGU, in any case that the current level of basic services will not be able to accommodate the demand due to in-migration;
- Expand public services coming from revenues because of food expenditures of workers; and
- Develop and implement community feedback procedure with clearly assigned responsibilities and targets for response and resolution times.

The following subsections present the existing basic services that are available in the host municipality and barangays. These services include water and power supply, communication and transportation services, enforcement of peace and order and educational and recreational facilities.

As mentioned above, these services may be overextended if there will be a drastic increase in the population of the host municipality and barangays as a result of influx of workers, migration of their family members, and other individuals seeking opportunities in the project areas. By looking at the current level of service provided and the demand for these services, San Miguel Foods Inc. (SMFI) can prepare a management plan that will prevent potential resource competition and scarcity of resources in the future brought about by the project.

Water supply

The Mariveles Water District (MARIWAD) is the primary distributor of water in the Municipality of Mariveles. MARIWAD acquires water supply from 20 deep wells sources, seven have elevated steel tanks and one has a ground reservoir.

Alternatively, the Freeport Area of Bataan (FAB), former Bataan Economic Processing Zone (BEPZ), has built its own water dam, water treatment plant and water distribution in 1970 to serve its locators and residents.

Based on the data of Local Water Utilities Administration (LWUA) in 2017, there are 128 ground water wells in Mariveles. Of these, only 24 are directly operated by MARIWAD and the rest are owned and operated by private individuals, barangays, and establishments.

There is no septage treatment facility (STP) in the municipality that is owned or operated by the LGU nor the water district. The only STP is situated at FAB which serve its locators and residents.

Power Supply

The Peninsula Electric Cooperative, Inc. (PENELCO) is the primary distributor of electric power supply to the Municipality of Mariveles and 11 other municipalities in Bataan. Based on the PENELCO's report last December 2015, all 18 barangays have accessed to electricity. There are 77 Barangay Power Associations (BAPAs) involving 56 sitios. In general, there are 28,958 service connections established in the Municipality of Mariveles. According to the data gathered of CBMS in 2014, 33,008 households have accessed to electricity. Of these, 32,994 are connected to PENELCO while the remaining households are connected to solar, generators and batteries. As to the project affected barangays, Barangay Lucanin has 824 households supplied by electric company, 18 households by generator, 37 households by solar and 7 by battery. Barangay townsite has 1,383 household energized by electric company, and 11 by generator.

On the other hand, the FAB is getting its power supply from GN Power, a 600 megawatts clean coal-fired power plant, to serve its locators and residents. Alternatively, FAB has incentives to its locators that use clean energy resources. At present, one locator established a solar farm located in FAB that generates electricity for its own use.

Communications

Based on the CBMS survey in 2015, 1,694 households maintain internet connection in their houses. 7,722 owned cellphones and 257 owned telephones as communication tools. In general, 15,716 households owned communication devices in the Municipality of Mariveles. As to the affected barangays of the project, Barangay Lucanin has 701 households with communication devices on their own and 635 households for Barangay Townsite and 512 households for Barangay Alion .

Peace and Order and Crime Rate

As to protective services, the 2015 data of Philippine National Police (PNP) shows that there are 42 PNP personnel for the Mariveles Police Station designated to 5 Station/Sub Station Patrol Base with 3 motor vehicle and one motorcycle. The police population ratio in 2014 is almost 1:3 which is below from 1:5 population ratio.

Most of the index crimes recorded by the PNP at the Mariveles Police Station involved physical injuries. Overall, there are 12 index crimes reported in 2015 wherein 9 were cleared or 20% of Bataan and 6 were solved or 19% of Bataan (**Table 2-42**).

Table 2-42 Crime Volumes – Index Crimes

CLASSIFICATION	MARIVELES	OTHER MUNICIPALITIES / CITY	BATAAN	MARIVELES % OVER TOTAL PROVINCE WIDE
Crimes Against Persons				
Murder	0	4	4	0%

CLASSIFICATION	MARIVELES	OTHER MUNICIPALITIES / CITY	BATAAN	MARIVELES % OVER TOTAL PROVINCE WIDE
Homicide	0	0	0	NA
Physical Injury	6	15	21	29%
Rape	0	8	8	0%
Crime Against Property				
Robbery	3	8	11	27%
Theft	2	13	15	13%
Carnapping	1	4	5	20%
Cattle Rustling	0	0	0	NA
Total Index Crimes	12	52	64	19%
Index Crimes Cleared	9	37	46	20%
Index Crimes Solved	6	25	31	19%

Source: CLUP of Mariveles, 2017-2026

On the other hand, most of the recorded non-index crimes (**Table 2-43**) by the Mariveles PNP involved violation of special laws. These non-indexed crimes concerned to the violation of Anti-violence Against Women and Children (VAWC) Law as discussed during the visioning workshop held for the preparation of CLUP for Mariveles. In total, there are 43 recorded non-index crimes in which 41 were cleared or 14% of Bataan and 39 were solved or 14% of Bataan.

Table 2-43 Crime Volumes – Non-Index Crimes

CLASSIFICATION	MARIVELES	OTHER MUNICIPALITIES / CITY	BATAAN	MARIVELES % OVER TOTAL PROVINCEWIDE
Homicide	0	4	4	0
Physical Injury	6	79	85	7
Damage to Property	3	91	94	3
Violation of Special laws	28	88	116	24
Other Non-index crimes	6	20	26	23
Total Non-index crimes	43	282	325	13
Non-index crimes cleared	41	262	303	14
Non-index crimes solved	39	236	275	14

Source: CLUP of Mariveles, 2017-2026

Presented in

Table 2-44, there are 55 crime volume documented by the Mariveles PNP. 50 were cleared and 45 were solved, resulting in a crime efficiency rate of 82%. Equating to Bataan efficiency rate, Mariveles is 3% higher resulting to 104% rate over province wide.

Table 2-44 Crime Volumes Summary

Classification	Mariveles	Other Municipalities / City	Bataan	Mariveles % over total provincewide
Total Crimes Volume	55	334	389	14%
Total Crimes Cleared	50	299	349	14%
Total Crimes Solved	45	261	306	15%
Crime Solution Efficiency	82%	71%-89%	79%	104%

Source: CLUP of Mariveles, 2017-2026

Based on the 2015 Bureau of Fire Protection/Office of the Provincial Fire Marshal, a total of six (6) fire incidents were recorded due to accident.

Educational Facilities

As cited in the CLUP of Mariveles and retrieved from the Department of Education Division of Bataan website, **Table 2-45** shows the existing elementary schools in Mariveles. At present, all barangays in Mariveles have existing elementary schools in their vicinity.

Table 2-45 Elementary Schools in Mariveles

Elementary Schools	Location
Antonio G. Llamas Elementary School	Barangay Poblacion
Alasasin Elementary School	Barangay Alasasin
Balon Elementary School	Barangay Balon
Baseco Elementary School	Barangay Baseco
Batangas II Elementary School	Barangay Batangas II
Bayview Elementary School	Barangay Alion
BEPZ Elementary School	Barangay Malaya
Biaan Aeta School	Barangay Biaan
Cabcaben Elementary School	Barangay Cabcaben
Ipag Elementary School	Barangay Ipag
Lucanin Elementary School	Barangay Lucanin
Marina Bay Elementary School	Barangay Alasasin
Mountain View Elementary School	Barangay Mountain View
New Alion Elementary School	Barangay Alion
Old Alion Elementary School	Barangay Alion
Renato L. Cayetano Memorial Elementary School	Barangay Maligaya
Sisiman Elementary School	Barangay Sisiman
Sto. Niño Biaan Elementary School	Barangay Biaan
Townsite Elementary School	Barangay Townsite

Source: www.bataan.gov.ph

In terms of Secondary level, the following tables show the existing public and private high schools in the municipality of Mariveles.

Table 2-46 Junior High Schools in Mariveles

JUNIOR HIGH SCHOOLS	LOCATION
Biaan Integrated Schools	Barangay Biaan
Ipag High School	Barangay Ipag
Mariveles NHS Cabcaben - Alasasin	Barangay Alasasin
Mariveles NHS – Cabcaben	Barangay Cabcaben
Mariveles NHS Cabcaben – Alion	Barangay Alion
Mariveles NHS Cabcaben - Annex (Batangas II)	Barangay Batangas II
Mariveles NHS – Malaya	Barangay Malaya
Mariveles NHS – Poblacion	Barangay Poblacion
Mariveles NHS Poblacion - Sisiman	Barangay Sisiman

Source: www.bataan.gov.ph

Table 2-47 Senior High School in Mariveles

SENIOR HIGH SCHOOLS	LOCATION
Biaan Integrated Schools	Barangay Biaan
Mariveles NHS Cabcaben - Batangas II	Barangay Batangas II
Mariveles NHS Cabcaben - New Alion	Barangay Alion
Mariveles NHS – Malaya	Barangay Malaya
Mariveles - Camaya Campus SHS	Barangay Camaya
Mariveles - Sitio Mabuhay SHS	Barangay Cabcaben

Source: www.bataan.gov.ph

Table 2-48 Private Secondary Schools in Mariveles

PRIVATE SECONDARY SCHOOLS	LOCATION
BEPZ Multinational Schools	Barangay Malaya
Blessed Regina Protman Catholic School	Barangay Mountain View
Llamas Memorial Institute	Barangay Poblacion
Mountain View Village School	Barangay Mountain View
St. Nicholas Catholic Schools of Mariveles	Barangay Poblacion
Sunny Hillside School	Barangay Ipag

Source: www.bataan.gov.ph

In terms of tertiary level, the Polytechnic University of the Philippines – Bataan and Maritime Academy of Asia and the Pacific are the existing universities and colleges institution in municipality.

Recreational facilities / sports facilities

The following are the major sports and recreational facilities in Mariveles, according to the Bataan Province ‘s Tourism website as cited in Mariveles CLUP.

- **Sitio 31** is used to be the Base Camp of the Filipino American defenders belonging to the 31st artillery battery who fought for the rear of Bataan Peninsula against the Japanese invaders. It is located at Barangay Biaan and a suitable field course for airsoft gaming.
- **Alas-asin trail kamaya point playground** is short 10K loop of single track and 'ober-da-bakod' climbs. This is a training ground for newbie riders who wants to experience the single-track challenges, learn shifting techniques, and loves exceptional scenery.
- **Karagatan Bay View Peaks** is the yearly venue for Padyakan sa Bataan held during the celebration of Araw ng Kagitingan. It is a short 5 kilometers circuit that offers challenging terrain and breath-taking views of Mariveles extra-ordinary gift of nature such as Mariveles valley, the Corregidor Island, Manila Bay and Mt. Mariveles.
- **Quinauan Point Trail** known as "The Ride of the Lifetime". The trail going to the cove of Quinauan is blatant with rock gardens, fire roads and a forested area. The cove is filled with primeval acacia and fire trees, green cogon fields that disappear the trails and rolling hills. The crystal blue water and the white sand beach cove of Quinauan is the reward of 7 kilometers downhill.
- **The Santa Monica Trail** starts and ends at the BEPZ building. The early part of the ride is a concrete road climb to the trailhead until it became a single track of fire roads and paved roads.
- **Tarak Ridge** is located at Barangay Alasasin. It is a 5 to 6 hours mountain climb to the peak which stands at 1,130ft above sea level. Mt. tarak is ideal for mountain trekking, climbing and exploration. It has a wide and thick forest, ridges, walls, and rivers.

2.3.6 Threat to public health and safety

Availability of public services in terms of health resource (government and private)

There is no tertiary public hospital in the municipality, however the following clinics take care to the health and medical needs of the residents. **Table 2-49** shows the data gathered of Provincial Planning and Development Office (PPDO) and cited in Mariveles CLUP, the existing medical and laboratory clinics in the municipality in 2015. Data presents that majority of the establishments were sited in Barangay Poblacion.

Table 2-49 Medical and Laboratory Clinics in Mariveles

Medical and Laboratory Clinics	Location
Ace Our Lady of Fatima Especialty & Diagnostic Clinic	Barangay Poblacion
De Leon Valencia Lying In Clinic	Barangay Cabcaben
Dr. Willie D. Calimbas Family Medical Clinic	Barangay San Carlos
Eleanor Valencia Arenas Maternity Clinic	Barangay Poblacion
Guzorell Medical & Surgical Clinic	Barangay Poblacion

MEDICAL AND LABORATORY CLINICS	LOCATION
Healthy Mom's Obgyn & Medical Clinic	Barangay Poblacion
Remedios Medical Clinic	Barangay Poblacion
St. Camille's Mother & Child Clinic	Barangay Cabcaben
St. Roche Medical & Diagnostic Clinic	Barangay Poblacion
Zubiri Medical Clinic	Barangay Cabcaben

Source: CLUP of Mariveles, 2017-2026

In terms of mental healthcare, the Mariveles Mental Hospital cater the needs of residents and nearby municipality and provinces. The establishment has 500 bed capacity.

As to dental and optical services, **Table 2-50** shows the existing establishment in the municipality of Mariveles that offers dental and optical services.

Table 2-50 Dental and Optical Clinics in Mariveles

DENTAL CLINICS	LOCATION
E.M. Araojo Dental Clinic	Barangay Townsite
Hansced Dental Clinic	Barangay San Carlos
MB Culala Dental Clinic	Barangay San Carlos
Hollis Dental Clinic	Barangay San Isidro
Monteagudo Dental Clinic	
Yambao Dental Clinic	Barangay San Carlos
OPTICAL CLINICS	**LOCATION**
Urriquia Optical	Barangay Poblacion
Janine Optical Clinic	Barangay San Carlos

Source: CLUP of Mariveles, 2017-2026

In general, majority of these establishments are operating in Barangay Poblacion and San Carlos since these barangays are the center of commerce and trade in the municipality.

Mortality

In 2014, there are 924 births in the Municipality wherein 479 are male and 445 are female. In 2013, the total number of deaths occurred in the municipality is 381 in which 212 are male and 169 are female. Out of 381 deaths, 30 were infant death (16 Male, 14 Female). Also, there are 5 fetal death and 2 Maternal deaths in 2013. There are 2,093 total births and 252 deaths recorded by the population of Mariveles resulting to net addition of 1,841 in the year 2015.

Table 2-51 presents the 2022 and 2023 leading causes of death in Barangays Alion and Lucanin.

Table 2-51 Leading Causes of Death in Barangays Alion and Lucanin (2022 and 2023)

BARANGAY ALION			BARANGAY LUCANIN		
Cause of Death	**Number (2022)**	**Number (Jan -Sept 2023)**	**Cause of Death**	**Number (2022)**	**Number (Jan - Sept 2023)**
1) OLD AGE		5	1Myocardial Infarction (Heart Attack)	13	5
2) Diabetes		3	2. Acute Renal Failure	2	-
			3. Chronic Kidney disease	1	1
			4. Non Hogkin Lymphoma	1	-
			5. Covid 19 suspect	1	-
			6. Acute Pulmonary Failure	1	-
			7. Hypertensive Vascular Disease	-	2
			8. Traumatic Brain Injury	-	1
			9. gunshot	-	1

The leading cause of deaths in Barangay Lucanin as of September 2023 data is Myocardial Infarction (Heart Attack) with 5 number of deaths recorded, followed by Hypertensive Vascular Disease with 2 incidents recorded. Barangay Alion reported about 5 people died for old age and 3 persons died with Diabetes.

Morbidity

Table 2-52 presents the 2021 leading causes of morbidity in Barangays Townsite, Alion and Lucanin.

Table 2-52 Leading Cause of Morbidity in Barangays Townsite, Alion and Lucanin (2022,2023)

BARANGAY ALION			BARANGAY TOWNSITE			BARANGAY LUCANIN		
Cause of Death	**Number (2022)**	**Number (Jan - Sept 2023)**	**Cause of Death**	**Number (2022)**	**Number (Jan - Sept 2023)**	**Cause of Death**	**Number (2022)**	**Number (Jan - Sept 2023)**
1.Acute Respiratory Infection	-	107	1. Wounds	139	-	1.Acute Respiratory Infection	67	183
2.Animal Bite	-	69	2.Animal Bites (Dog)	116	179	2. Wounds	56	51
3.Wounds (All Kinds)	-	36	3.Urinary Track Infection	114	50	3. Urinary Tract Infection	48	80
4.Urinary Track Infection	-	23	4.Acute Respiratory Infection	94	-	4. Skin Disease	35	15
5.Hypertension	-	16	5. Hypercholesteremia	18	18	5. Tuberculosis	28	20
6. Tuberculosis	-	14	6. Hand foot, Mouth Disease	16	-	6. Animal Bite	23	187
7.Diabetes Mellitus	-	10	7. Muscucoskeletue Disorder	14	-	7. Anemia	18	38
8. Disilidemia	-	10	8. Asthritis	14	10	8. Hypertension	13	15
9. Hyperricemia	-	11	9. HPN	13	39	9.Hand,Foot and Mouth Disease	13	-
10.Skin Disease	-	8	10. Sorethroat	8	-	10.Diabetes Mellitus	5	20
			11. Viral ex anthem	6	-	11.Acute Pharyngitis	-	14
			12. Diabetes	15	-			

The leading disease for Barangay Lucanin is due to animal bite with 187 recorded incidents followed by Acute Respiratory Infection with about 183 reported cases. Barangay Alion reported about 107 cases with Acute Respiratory Infection, followed by animal bites with about 69 incidents. Barangay Townsite reported also about 179 cases of animal bites and with Urinary Tract Infection (UTI) with 50 cases.Other reported diseases for the three Barangays includes Hypertension, Diabetes, Tuberculosis and skin diseases.

Environmental Health and Sanitation Profile

a. *Access to Safe Water*

Based on the 2015 data of Provincial Health Office (PHO) of Bataan, all 21,576-household surveyed have accessed to safe water supply. On the other hand, based on the survey conducted of CBMS between 2010 to 2015. There are 905 households without access to safe water. These households are comprised of 7,181 individuals.

b. *Access to Toilet Facility*

The 2015 PHO data on Household Toilet Facilities (**Table 2-53)** shows that there are 752 household without access to sanitary toilet facilities. Conversely, almost 97% have sanitary toilet facility in the Municipality of Mariveles which is 6% higher from the general population of the province.

Table 2-53 Household Toilet Facilities

MUNICIPALITY	TOTAL NUMBER OF HOUSEHOLD	HOUSEHOLD WITH SANITARY TOILET FACILITY	
		FREQUENCY	PERCENTAGE
Mariveles	21,576	20,824	97%
Bataan	127,428	116,577	91%

Source: CLUP of Mariveles, 2017-2026

c. *Solid Waste Disposal*

Similarly, the 2015 data on Households with satisfactorily Disposal on Solid Waste (**Table 2-54**) reveals that 1,428 households with poor solid waste disposal. On the contrary, 93% of the households have adequately solid waste disposal in the Municipality of Mariveles.

Table 2- 54 Solid Waste Disposal in Mariveles

MUNICIPALITY	TOTAL NUMBER OF HOUSEHOLD	HOUSEHOLD WITH SATISFACTORILY DISPOSAL ON SOLID WASTE	
		FREQUENCY	PERCENTAGE
Mariveles	21,576	20,138	93%
Bataan	127,428	109,048	86%

Source: CLUP of Mariveles, 2017-2026

The Project may pose adverse impacts on the existing public health and safety conditions of the project-affected communities as a result of in-migration. These include the following:

- Spread of communicable diseases specially COVID- 19;
- Noise from construction activities;
- Exposure to dust produced during excavation, emissions of SO_2, NO_x, CO and other volatile compounds may manifest acute and chronic signs symptoms and illnesses; community exposure may come from various environmental pathways (e.g. air, water which reach the vulnerable sectors of the population)
- Increased in solid wastes as a result of population increase and demand for food supply and other consumable materials;
- Indirect health impacts may include economic dislocation, inadequacy or disruption of social services, community disintegration as a consequence of development caused by factors that include migration into the community because of availability of work, increasing demand for health and food resources and other services.

The following measures will be established to minimize the potential impacts on public health and safety:

- Establish an Occupational Safety and Health program specific for the project;
- Observe proper solid waste collection, handling and disposal;
- Establish a Solid Waste Management program that will handle the domestic wastes that will be generated by the project to reduce the amount of solid waste that will ultimately be disposed in sanitary landfills or elsewhere; and
- Close coordination with community leaders of the receiving community in promoting peace and order and acceptable lifestyle.

2.3.7 Generation of Local Benefits from the project

Enhancement of employment and livelihood opportunities

It is expected that the Project will generate employment that will benefit the residents of the host barangays. SMFI will compensate appropriate significant amount of money on wages during the construction period. This could have significant impact on household income and local and regional economies.

It is estimated that approximately 250 people will be employed by the project during the pre-construction and construction period is yet to be determined. To ensure equal and fair access to employment and maximize the opportunities for local participation, a strategic workforce management measures will be implemented. Measures will employ "local first" hiring policy in coordination with Public Employment Services Office (PESO) of the Municipality of Mariveles. Prior to start of construction activities, the municipal government and SMFI and its Contractor will also engage into a regular consultation with the stakeholders of the host barangays on the job requirements and hiring process to maximize local hiring.

a. *Sources of Income/ Livelihood*

Based on the household survey conducted by the CBMS Census 2010-2015, there are 6,533 households with income below the poverty threshold. It is composed of 30,659 individuals in which 51% are female while the rest are male.

Households with income below the food threshold in the municipality totaled to 5,031 comprised by 48,489 individuals with 24,654 female and 23,835 males.

Meanwhile, households who experience food shortage totaled to 42 households represented by 511 individuals wherein 269 are male and 242 are female.

About 87% of the population of Mariveles in 2011 is part of the labor force. Data revealed the 32,648 employed members of the labor force, almost 63% of the labor force population are male while the rest are female. (**Table 2- 55**).

Table 2- 55 Employment Profile

CATEGORY	MALE	FEMALE	TOTAL
Labor Force	23,493	13,878	37,371
Employed	20,519	12,129	32,648
Employment Rate	87.34%	87.40%	87.36%

Source: CLUP of Mariveles, 2017-2026

In terms of workers classification in July 2015, majority of the employed residents are connected in production with 92%, followed by management and administration with 5% and 3% on technical job related.

As to distribution of workers by employer in the same period, 58% were employed to locators in Freeport Area of Bataan, 29% were connected to agencies and cooperatives and 11% by TESDA. The remaining percentage are associated to commercial establishments.

Increased business opportunities and associated economic activities

a. *Commercial Establishment and activities*

There are variety of commercial establishments in the Municipality of Mariveles clustered into primary, secondary, and tertiary. The Primary sector involves activities that utilize, produce and process raw material into primary goods. Secondary sector covers the manufacturing and producing of raw materials and input generated from primary sector. The tertiary level encompasses to industries engaged in manufacturing activities which consume massive quantity of energy.

The primary sector agricultural activities in producing and cultivating rice, corn, cassava, plantation crops and other upland crops. Fishing is not the major contributor despite the fact of body of water surrounds it. Secondary sector includes the industrial business establishments located in FAB, companies operating in PNOC Industrial Park, Baseco Compound and companies operating outside the industrial area.

As of 2016, the business establishments operating in the municipality and categorized under tertiary sector totaled to 1,480. Dry goods and sari-sari stores dominates these establishments recording a total of 196. Some of the other business establishments identified in the vicinity of municipality are drug stores (17), eateries (21), fish vendor (52), fruit store (16), trading establishments (49), general merchandise (47), commercial space (76), medical clinic (44) and many others. The municipality operates 5 wet public markets.

b. *Banking and financial institutions*

Banking and financial institutions were involved in 1,480 establishments categorized in tertiary sector. There are 17 cooperatives, 1 commercial bank, 2 thrift banks, 2 rural banks, 7 lending investors, 13 money changers, 2 finance and investment co., and 18 pawnshops.

The major banks in the area include Land Bank of the Philippines (LBP), Metropolitan Bank & Trust Corp (MBTC), Banco De Oro (BDO), Philippine National Bank (PNB) and Eastwest Bank.

In terms of financial institution, the Municipality of Mariveles displayed a general improvement in ranking among all municipalities and cities from 95th rank to 39th rank in 2016

Increased revenue of LGUs

Created employment and livelihood opportunities will result to increase in household income of community residents. By having such income, household members will have higher purchasing power to acquire basic needs such as food, local goods and services that are available in the host municipality and barangays. Regular consumer expenditure of the community residents will infuse significant amount to the local economy. In turn, these expenditures will help sustain or create opportunities for business and employment in the host municipality and barangays.

Additional tax revenues will also be collected from winning contractor and private organizations and individuals who will be establish businesses in the area.

2.3.8 Traffic Impact Assessment

Presented in **Table 2-56**, Motorcycle/Tricycle dominate the public transportation in the Municipality of Mariveles, based on the data from 2011-2014, 89% of the total public transportation were tricycles. As of 2014, there are 4,650 motorcycles operating and increasing its number. Jeepneys (PUJ) operating percentage is constant at 6% from 2011 to 2014. There are 300 units of PUJ transporting. Busses transporting inter and intra-regional were at 5%. 240 busses were listed in 2014. Air-conditioned busses regularly travel to Manila and vice-versa.

Table 2-56 Public Transport Vehicles

PUBLIC TRANS. VEHICLE	2011		2012		2013		2014	
	FREQUENCY	%	FREQUENCY	%	FREQUENCY	%	FREQUENCY	%
Tricycle	4,198	89%	4,243	89%	4,496	89%	4,650	89%
Jeepney	285	6%	290	6%	300	6%	300	6%
Busses	230	5%	230	5%	240	5%	240	5%
Total	**4,713**	**100%**	**4,763**	**100%**	**5,036**	**100%**	**5,190**	**100%**

Source: CLUP of Mariveles, 2017-2026

The two current private bus companies operating in Mariveles providing trips to and from Metro Manila and other nearby provinces were Bataan Transit and Genesis Transport Services. Bataan Transit have 45 existing units 20 routed Mariveles-Avenida vice-versa and Mariveles-Pasay vice-versa. Genesis Transport Service have 48 existing units, 30 routed Mariveles-Avenida vice versa, 12 Mariveles-Pasay vice versa and 12 Mariveles-Baguio vice-versa.

Mini busses offer inter-provincial trips between municipality of Mariveles and provincial capital of Balanga, a 47kms distance. There are 149 units of mini busses that take 2 round trips daily.

The Municipality of Mariveles has a road network of approximately 292.89 kms. Barangay Alas-asin has the longest barangay road network with 62.86 kms, Balon Anito has the lengthiest municipal road with 7.46 kms and Biaan with the longest national road by 17.37kms.(**Table 2-57**).

Table 2-57 Road Inventory and Classification by Road Type

BARANGAY	ROAD TYPE

	Barangay		Municipal		National		Total
	Length (kms)	%	Length (kms)	%	Length (kms)	%	
Alas-asin	62.86	29	-	0	9.53	16	72.39
Alion	5.49	3	0.79	5	-	0	6.28
Balon Anito	8.30	4	7.46	50	6.55	11	22.31
Baseco County	5.17	2	-	0	2.5	4	7.67
Batangas II	19.63	9	2.11	14	3.27	5	25.01
Biaan	-	0	0.28	2	17.37	29	17.65
Cabcaben	10.47	5	0.65	4	0.7	1	11.82
Camaya	5.27	2	-	0	0.07	0	5.34
Ipag	2.67	1	1.6	11	4.27	7	8.54
Lucanin	8.15	4	-	0	1.95	3	10.10
Malaya	11.92	5	-	0	0.46	1	12.38
Maligaya	25.49	12	-	0	6.15	10	31.64
Mountain View	28.67	13	1.14	8	1.81	3	31.62
Poblacion	5.76	3	-	0	1.05	2	6.81
San Carlos	1.22	1	-	0	-	0	1.22
San Isidro	2.50	1	-	0	0.6	1	3.10
Sisiman	5.83	3	-	0	2.61	4	8.44
Townsite	8.19	4	0.94	6%	1.44	2	10.57
Total	**217.59**	**100**	**14.97**	**100**	**60.33**	**100**	**292.89**

Source: CLUP of Mariveles, 2017-2026

The data gathered from the Department of Public Works and Highways (DPWH) as cited in Mariveles CLUP, the annual average daily traffic (AADT) (**Table 2-58**) in the municipality of Mariveles in 2013 and 2015 shows a significant increase in traffic volume along the Mariveles-Talaga Bay Road by 91%; Sisiman Port Road by 51% and EPZA By-Pass (Baraso Country Road) by 47%. Meanwhile, the Ramon Expressway substantially decrease in traffic volume by 124%.

Table 2-58
Annual Average Daily Traffic in Mariveles, 2013 and 2015

Section ID	Road Name	AADT		Variance	% Change
		2015	2013		
S01349LZ	EPZA By-Pass (Baraso Country Road)	2,734	1,440	1,294	47%
S01310LZ	Mariveles-Talaga Bay Road	2,734	240	2,494	91%
S01362LZ	Sisiman Port Rd	5,999	2,961	3,038	51%
S01348LZ	Alas-asin Port Rd	2,186	4,292	- 2,106	-96%
S01313LZ	Roman Expressway	7,280	16,333	- 9,053	-124%
S01307LZ	JCT Layac-Balanga-Mariveles Port Rd	7,356	10,153	- 2,797	-38%

Source: CLUP of Mariveles, 2017-2026

During construction, transport of hauled soils, heavy loads of construction materials, and workers to the project site has the potential to add traffic congestion. A traffic management plan will be developed as part of the overall EMP to address traffic movement during construction of the Project and ensure continued safe operation of road intersections near the project areas. The traffic management plan will also address vehicle safety and mandatory practices for contractors. The plan will include traffic diversion routes and rerouting schemes that were carefully studied. The hauling services and movement of the construction vehicles should be scheduled.

It is important to note that all traffic diversion schemes, and management plans should be properly coordinate with the LGU, the local office in charge of traffic management and the directly affected barangays.

Prior to implementing the traffic re-routing plan, the public must be in formed in advance. The method of informing the public would be left to the discretion of the proponent. Options include posting notices in public places, in local newspapers, through local radio and television programs or through public address systems.

2.3.9 Public Participation

2.3.9.1 Information Education Communication (IEC) Campaign

The main objectives of the IEC are the following: discuss the project components to the affected communities, gather the issues and concerns of stakeholders and explain the future activities of the project in the preparation of the Environmental Impact Statement Report.

The Information Education Communication (IEC) Campaign for the affected barangays such as Lucanin, Alion and Townsite were conducted on February 8,2023. The IEC activities were held are in Brgy. Lucanin Covered Court at 8:30 am, Brgy. Alion Covered Court at 10:30 and Brgy. Townsite at 02:00 pm.

The basic project profile of the proposed Lucanin Multi-Tier Broiler Project Project was presented to the stakeholders.

Issues and Concern at the Open Forum

The following are the opinion, issues and concerns raised during the open forum:

Table 2-59 Issues and Concerns of Barangay Lucanin

MAJOR QUESTIONS AND ANSWER			
NAME/POSITION	QUESTION	NAME/POSITION	ANSWER
Alfredo Mojica –	The proposed project of	**Juan Paulo D. Salino-**	SMFI will mitigate the

MAJOR QUESTIONS AND ANSWER			
NAME/POSITION	**QUESTION**	**NAME/POSITION**	**ANSWER**
Kagawad, Barangay Lucanin	SMFI is a good project but its perilous to the people. He stated that "Kapag ito'y natuloy, patay na kami". He is highly concerned about the possible foul smell emitted of the proposed project once established.	Environmental Specialist	smell by using advance technologies and maintain its sanitation. As shown in the video presented, ventilation is part of the study conducted by the SMFI.
Ludivino A. Funilas - Chairman, Barangay Lucanin	He stated that operations of broiler farm was already operational to other towns of Bataan that emit "Maraming langaw at yung amoy" . Also requested that the Barangay Captain of Alion and Townsite should be present in a one venue for a consultation meeting.	**Maricel Domingo** Project Coordinator	She stated, "it just the beginning", Public Consultation will be conducted in the future, wherein the three barangays will be invited to address the concern simultaneously.
Cecilia Sandolan – Samahan ng Mangingisda, Member	She is concerned about the foul smell and its possible impact to the environment. She stated that their group is not in favor of the proposed broiler and worried for the next generation's future.	**Juan Paulo Salino**- Environmental Specialist	Sentiments were recognized. Study is still on-going. Once done, results will be presented in the Public Consultation Meeting.
Ferdinand Bancua – Barangay Fisheries and Aquatic Resources Management Council, President	In his point of view, the proposed project will affect the community and the environment. He stated that some poultry was petitioned in Bagac due to its effect to the people. He also concerned about the possible impact of the project to the people.	**Juan Paulo Salino**- Environmental Specialist	Sentiments were acknowledged. Detailed result of the study will be presented in Public Consultation Meeting to address the concerns asserted.
Julie Ann Capuli - Kagawad on Health and Sanitation, Barangay Lucanin	Based on her experience in their house in Limay, Bataan, during harvest season, plenty of flies infested their place. The smell emitted is inevitable. If she will be asked personally, she is not in favor about the project.	**Juan Paulo Salino**- Environmental Specialist	Sentiments were recognized.
Elizabeth Rosal – Kagawad, Barangay Lucanin	She stated that citizens should listen carefully because they are the one	**Juan Paulo D. Salino**- Environmental Specialist	Sentiments were recognized.

MAJOR QUESTIONS AND ANSWER			
NAME/POSITION	QUESTION	NAME/POSITION	ANSWER
	to decide for the project. She said that " pakinggan ninyo ang layunin nila kung ikabubuti natin o hindi….kung ang proyekto nila ay makakabuti o makakatulong sa atin o tayo ay maaapektuhan"		
Ernesto Ronsalio – Resident of Barangay Lucanin	He is concerned about jobs to be produced most especially to senior citizens who still want to work like him.	**Juan Paulo D. Salino**- Environmental Specialist	Part of the study is to assess the existing social condition of the community. Social aspects include the possible hiring of the locals based on the manpower requirements.

Table 2-60 Issues and Concerns of Barangay Alion

MAJOR QUESTIONS AND ANSWER			
NAME/POSITION	QUESTION	NAME/POSITION	ANSWER
Romeo P. Celorico - Kagawad, Barangay Alion	He is concerned about the smell to be emitted of the proposed project. He asked "Ang amoy po ba ay hindi kami maapektuhan?"	**Juan Paulo D. Salino**- Environmental Specialist	It is part of our study; we will be having a Public Consultation wherein we will present the result of investigation.
Pastor Podol - Kagawad, Barangay Alion	He is concerned about the health of its constituents. If the proposed project will be implemented, infestation of "bangaw" may occur. He also added and emphasized three points: 1. Health; 2. Youth – "lumaking malusog"; and 3. Tourism – income generating industry.	**Juan Paulo D. Salino**- Environmental Specialist	Stated that the objective of the IEC activity is to inform all the possible barangays to be affected. A Public Consultation will be organized in the future to address all the concerns raised.
Maximo Melanio Jr. - Kagawad, Barangay Alion	He stated, "Ano bang advantages and disadvantages namin diyan?". On his point of view, he is disagreeing with the project.	**Juan Paulo D. Salino**- Environmental Specialist	A Public Consultation will be organized in the future, all the advantages and disadvantages of the project will be explained in detailed.
Rowena Ibanez	She asked, "Bakit po tayo nagpa-public hearing kung hindi naman kami mapapakinggan?"	**Juan Paulo D. Salino**- Environmental Specialist	Concerns are all recognized and will be included in the report that will be submitted to AFAB. This IEC is only the first public consultation.
Irma A. Jawod – Kagawad, Barangay Alion	She is requesting to present SMFI existing good practices in managing broiler farm.	**Juan Paulo D. Salino**- Environmental Specialist	Presentation of existing good practices in managing broiler farm by the SMFI will be included in the next Public Consultation.

MAJOR QUESTIONS AND ANSWER			
NAME/POSITION	QUESTION	NAME/POSITION	ANSWER
Lolit Tubang – Kagawad, Barangay Alion	She is concerned about the benefits of the Barangay Alion in the proposed project of SMFI. She stated "yung itatayong broiler farm ay sa Lucanin ngunit yung amoy kami ay maapektuhan", she also emphasized that they will not be benefited with the project because all taxes will be paid directly to Lucanin.	**Juan Paulo D. Salino-** Environmental Specialist	Stated that Barangay Alion included in the study since it is one of the neighboring Barangays of Lucanin and may be affected of the project. All concerns raised will be discussed in the next Public Consultation.
Marshalito Balan – Chairman, Barangay Alion	He is concerned about political boundary involved in the proposed broiler farm of SMFI.	**Juan Paulo D. Salino-** Environmental Specialist	Sentiments were recognized.
Myrna Castillo – Upper Marives Kabalikat, President	Concerned about the possible foul smell, she stated "Usok pa lang ng kapit-bahay nagagalit na kami".	**Juan Paulo D. Salino-** Environmental Specialist	Sentiments were recognized.

Table 2-61 Issues and Concerns raised from Brgy. Townsite

MAJOR QUESTIONS AND ANSWER			
NAME/POSITION	QUESTION	NAME/POSITION	ANSWER
Ernest Lucio - Kagawad, Barangay Townsite	Asked the exact location of the proposed project of SMFI. He also added the job generation in the area (if hired locally) and the possible effect of smell and the infestation of "bangaw" in the area. In addition, he inquired regarding the environmental impact fee.	**Juan Paulo D. Salino-** Environmental Specialist	The proposed location is in Brgy. Lucanin, Mariveles, Bataan, inside the Ruzena Industrial Estate (boundary of Lucanin and Alion). Local First hiring policy will be observed based on the qualifications needed on the said manpower. Other concerns raised will be explained in Public Consultation.
Leandro Serrano - Rep. Interfaith Group Member, Barangay Townsite	Inquired regarding a study about the accountability of the company about the diseases caused by the project.	**Juan Paulo D. Salino-** Environmental Specialist	This will be included in the study. Also Impact Management Plan (IMP) will be formulated to
Antonio Camilo	He is concerned of the dead chickens if they are buried, the soil will be contaminated. Instead of burying, he proposed to grind also the chickens like the manure.	**Eduardo Romero-** Project Manager	The soil will not be contaminated since the mortality pit is concreted (water type).
Leonides P. Francisco Jr. – Kagawad, Barangay Townsite	He mentioned that the actual effect will just be shown once the project is being implemented. He proposed to conduct a meeting prior to the next Public Consultation Meeting to discuss all the issues raised during the IEC.	**Juan Paulo D. Salino-** Environmental Specialist	The proposed meeting is noted.
Marissa Obdin – Secretary, Barangay Townsite	Inquired regarding the services offered by the company (CSR) once operating. Also, the plans in case of emergence	**Juan Paulo D. Salino-** Environmental	A Public Consultation will be organized in the future, all other concerns raised will be

Major Questions and Answer			
Name/Position	**Question**	**Name/Position**	**Answer**
	of epidemic and diseases in the area.	Specialist	explained in the Public Consultation Meeting.
Carmelita Adame – Chairmen, Barangay Townsite	Expressed the sentiments in prioritization of work opportunity in the local of Townsite due to high number of unemployed in the barangay. She also added to lessen the standard of hiring policy most especially to blue-collar job like magtatabas and many more. She stated “pagaanin ang pagkuha ng requirement ng mga contractor”.	**Juan Paulo D. Salino**- Environmental Specialist	All sentiments were noted.

Initial Perception

The perception of each barangay to the project were gathered by recording all the sentiments and concerns raised during the open forum.

For Brgy. Lucanin, some residents pointed out the potential negative effects of the Broiler Farm to the nearby communities and expressed their objection to the project. However, the Brgy. Officials requested the residents to listen and understand the explanation / presentation of SMFI.

In Brgy. Alion, both the Brgy. Officials and residents expressed their objection to the project. They all raised their concerns to the potential negative impacts of the project to their community once implemented.

The Brgy. Officials of Brgy Townsite is requesting for another meeting to discuss all issues raised during the open forum and resolve it. They are also assessing the positive impacts of the project to their communities once implemented.

2.3.9.2 Courtesy call and Broiler Farm Visit

A courtesy call and visitation to Davao Broiler Farm and Limay Farm were conducted on May 3, 2023 and May 8, 2023, respectively. The visit aims to recognize and understand the technology that the proponent will use for the propose SMFI Lucanin Multi-Tier Broiler Project . **Plate 2-25** and **Plate 2-26** shows the activity and list of representatives joined the farm visit.

Plate 2- 25 Visit at Davao Broiler Farm with Mayor Ace Jello Concepcion

Plate 2- 26 Visit at Samson Broiler Far with Vice Mayor Angelito Rubia

Plate 2-27 Visit at Samson Broiler Far with Brgy Captain Carmelita Adame (Townsite)

2.3.10 Public Scoping Meeting

A Public Scoping Meeting for the proposed project was held on August 30,2023. It was attended by stakeholders from the Provincial Office of Bataan, Barangays of Lucanin, Alion and Townsite. **Table 2-62** presented the distribution of participants per sector.

Table 2-62 Attendees per Sector

SECTOR/UNIT	NO. OF PARTICIPANTS	
	MALE	FEMALE
Provincial Office of Bataan	2	1
Local Government Unit of Mariveles	13	2
AFAB	3	1
Barangay Alion	9	10
Barangay Lucanin	12	12
Barangay Townsite	25	22
SMFI and ARCHEN	30	7
Brown and Green	2	6

SECTOR/UNIT	NO. OF PARTICIPANTS	
	MALE	FEMALE
Total	96	61
Total Attendance	**157**	

The issues and concerns raised during the Public Scoping is presented **Table 2- 63.**

Table 2- 63 Issues and Concerns raised during the Public Scoping

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
1.	Project Description	Would it be possible that the biggest portion of the broiler farm will be located in Lucanin and the processing plant will be constructed in barangay Alion?	Lolit Tubang, Alion Barangay Councilor	SMFI stated that the first stage of the broiler farm is within Barangay Lucanin while the second stage of the broiler farm will be constructed near barangay Alion. The team will conduct a thorough study and will confirm if they can adjust the location farther from the neighboring communities. Moreover, SMFI assured that the proposed project is under a detailed study and all aspects are considered. The project will not be implemented if it will harm the people/community.
		Where is the location of the broiler farm? Based on the presentation, majority of the broiler farm will be constructed at the back door of the barangay Alion which is 30-50 meters away from the Sitio Inengles and Crossing.	Marcelito Balan, Alion Barangay Captain	
		I know the mindset of the people in a conventional poultry is that the manure is under the chicken cage, and it can be the source fly's infestation which will have negative effect to the community. However, with the use of technology, the probability of the fly's infestation in the proposed Broiler Farm is low. Let's see the actual effect of the project during its operation.	Ludivino Funilas, Lucanin Barangay Captain	None

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
		It is better for us to observe the technology so that we know how to address the people who have concerns about foul odor and files.	Ernesto Lucio, Townsite Barangay Councilor	SMFI answered that those who wants to visit the farm and observe if there is a bad odor and presence of flies will be entertained but they need to schedule the visit to avoid stressing of the chicken.
		How will you transport the chicken manure?	Ernesto Lucio, Townsite Barangay Councilor	San Miguel stated that they will use its own truck, clean and with cover in disposing /transporting the manure.
		Maybe you have a technology where the manure will be processed to become agriculturally beneficial.	Manolito Villena, MAFC Chairman	SMFI stated that the chicken manure will be processed to become fertilizer that will be transported to company's cassava plantation.
2.	Land	None	None	None
3.	Water	How are you going to address the rapid increase of water / flooding in the lower part of the Villa Imperial Subdivision affected by the ongoing project construction of San Miguel?	Raquelin Saco, Barangay Townsite resident	San Miguel said that they will visit the concerned area together with their contractor. They will assess the condition and recommend and take necessary actions to mitigate the flooding and eliminate the burden of the people.
		The residents of Villa Imperial Subdivision are anxious that their houses might be covered by mud, rocks and logs that come from the mountain.	Raquel Gib, Barangay Townsite resident	

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
		The mud water rapidly increases. San Miguel have a Corporate Social Responsibility and I hope that they will pay attention and take actions to the impacts of their project in the neighboring community/ subdivisions.		
		The canals and drainage in Lupang Pangarap are blocked because of the logs that came from the mountain. The people needed to vacate their houses because the flood water increased immediately whenever it rains. I hope San Miguel will address this concern immediately.	Jackelyn Bacon, Barangay Townsite resident	
		The impacts of the project are unavoidable, and we must face the problems that occurred. I recommend addressing the flooding issues by (1) Immediately cleaning the canal and drainage (2) If the flooding continuously happen, the help of the DPWH might be needed and (3) for safety, the residents near the river should be relocated	Ernesto Lucio, Townsite Barangay Councilor	San Miguel assured that they will visit and check the area. After, they will plan and recommend necessary actions on how to clean the creek and drainage to immediately address the flooding issues.

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
		For the information of the residents of the Townsite, the third district engineer and I visited and assessed the area of concern. One of the causes of flooding is the blockage of the canal. The water still flows however, the creek cannot contain the volume of the water that comes from the mountain due to incessant rain which cause the water traverse in the households. The district engineer will address the problem immediately to lessen the flooding in the area. To San Miguel, let's work together to immediately eliminate the flooding our area.	Carmelita Adame, Townsite Barangay Captain	San Miguel stated that they are compliant in all the environmental compliances, but they want to exceed the environmental requirements. They will address the issues and concerns about the flooding.
		About 30 to 40 percent of flood water and mud comes from Ruzena. Alot of farmers have been affected especially their livelihood. We can't avoid the flooding because of the deforestation. But the national government, local government and	Manolito Villena, MAFC Chairman	SMFI answered that they will conduct a monitoring. Their engineer will visit and assess the area. According to them, the people can come to their plant/ office if they have seen and experienced negative impacts of the project. They will be happy to assist them and address the problem.

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
		barangays can collaborate to prevent flooding by constructing a dike from the sea to Mambucog. Please take an immediate action to this proposed mitigation and implement it.		
		We raised our concerns to your supervisor, but no actions have been made from your part. The drainage in our community is still blocked by logs from the mountain. All we want is to clean our drainage to prevent flooding in our community.	Jackelyn Bacon, Barangay Townsite resident	San Miguel will visit and assess the problem and will provide a long-term solution. The SMFI's engineer together with its contractors will visit the concerned area. SMFI assured that they will not implement the proposed project without addressing the flooding issue first.
4.	Air	How far the flies can travel? Can you assure us that there are no flies and foul odor from the farm?	Lolit Tubang, Alion Barangay Councilor	San Miguel mentioned that the flies can fly within 5-kilometer radius however, it will not become a problem/concern because its life cycle is just 5 days. In the typical poultry, the manure will be stock in its slot (under the cage) in 30 days which is the source of the influx of flies since within 30 days, flies can lay eggs four (4) times a week. However, in the proposed broiler farm, the manure will be collected

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
				everyday which means flies have no chance to reproduce. San Miguel assured that there will be no foul odor and flies during the operation of the project.
5.	People	How does the people of Mariveles benefit in the project directly? How can we buy your products cheaper than other places?	Jun Villapando, Batangas Dos Barangay Captain	SMFI mentioned that company has a reseller program wherein the people can start a business with a small capital.
		Could you help the member of our association in putting up a business?	Manolito Villena, MAFC Chairman	SMFI stated that they have Magnolia Chicken Community Reseller Program. This program can help an individual start a business with just a small capital (Php 2,000) with high revenue because there is no service charge and franchising fee. Also, free cooler and marketing materials will be provided. According to them, the products will be delivered by San Miguel's distributors at the comfort of their home, and they can conduct a training for the interested individuals/ group.

EIA MODULE		ISSUES/SUGGESTIONS RAISED BY STAKEHOLDER	SECTOR OR REPRESENTATIVE WHO RAISED THE ISSUE/ SUGGESTION	PROPONENT'S RESPONSE
		Would it be possible to give us an organic fertilizer from chicken manure because our farmers need it.	Manolito Villena, MAFC Chairman	No response.

2.4 AIR

This section describes the existing meteorological and climatological condition of the Project site based on secondary and primary data. The potential impacts of the Project with respect to the sub-component of the air module are discussed in the following sections.

2.4.1 Meteorology/Climatology

2.4.1.1 Change in Local Climate

Methodology/Data Sources

There are three (3) nearby synoptic stations of the Philippine Atmospheric Geophysical Astronomical and Services Administration (PAGASA) from the project site (**Figure 2-49**), namely: Manila PAGASA Station (Port Area) in Manila, Sangley Point PAGASA Station in Sangley Point, Cavite, and Subic PAGASA Complex in Subic, Zambales. Due to the mountain ranges and peaks between the project site and Subic PAGASA Complex, meteorological data from Sangley Point PAGASA Station and Manila PAGASA Station were only utilized in this study.

Table 2-64 shows the coordinates, elevations, and distances of the said synoptic stations from the project site. The climatological normals of rainfall and air temperature were based on the latest climatological normals covering 1991 to 2020, while the climatological extremes up to 2020, as published on PAGASA's website.

Table 2-64 coordinates, elevations, and distances of the said synoptic stations from the project site

DESCRIPTION	SANGLEY POINT PAGASA STATION	MANILA PAGASA STATION (PORT AREA)
Location	Sangley Point, Cavite City	Port Area, Manila
Latitude (DMS)*	14°29'29.93"N	14°35'13.10"N
Longitude (DMS)	120°53'54.90"E	120°58'43.44"E
Elevation (m)	3	15
Distance to project site (km)	35.283	45.426

**DMS – Degrees Minutes Seconds*

The method by Palomino and Martin (1994) was used to estimate the rainfall and air temperature at the project site by interpolating the data at the nearby stations using the distance and elevation differences to the project site.

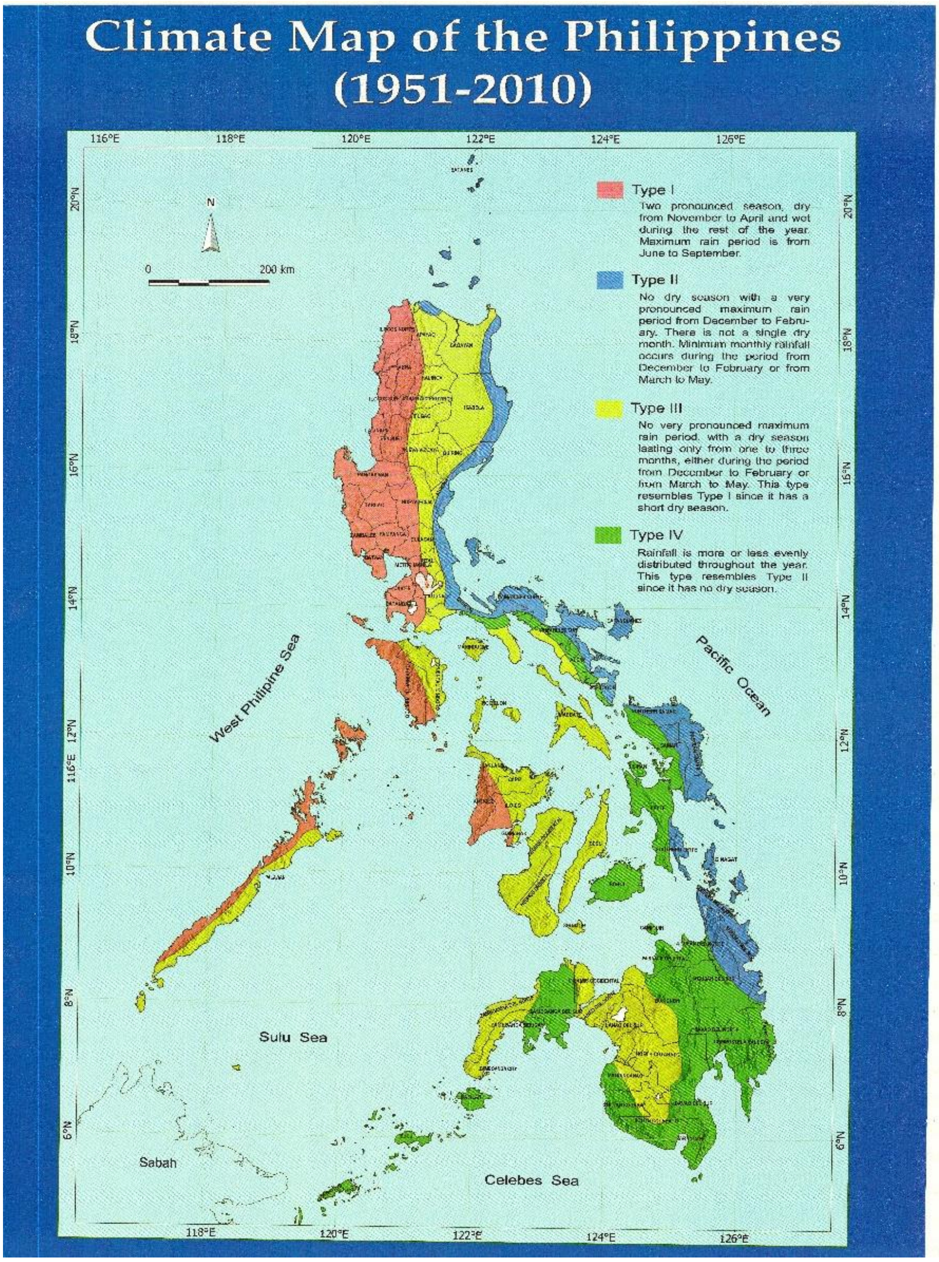
The sources of information in assessing the projected changes of normal and extremes of rainfall and temperature were based on the following studies:

- Observed and Projected Climate Change in the Philippines by the Department of Science and Technology (DOST) – PAGASA (or DOST-PAGASA, 2018), and
- Philippine Climate Extremes Report 2020 by the DOST-PAGASA, Manila Observatory, and Ateneo de Manila University

Climatological Normals and Extremes

Climate

The climate at the project site belongs to the Type 1 climate **Figure 2-49**. Type 1 climate has two (2) pronounced seasons, namely: dry and wet seasons. The dry season is from November to April and the wet season during the rest of the year (May to September).



Source: PAGASA

Figure 2- 49 Climate map of Philippines (1951 to 2010) and the locations of three (3) nearby synoptic stations of the PAGASA

Rainfall

The annual average rainfall at the project site (2241.8 mm) is lower than the average yearly rainfall in the Philippines (2526 mm).

The monthly average rainfall appears to increase starting in May (153 mm) until it reaches its peak in August (500 mm) (**Figure 2-50**). It then started to decrease in September (390 mm) until it reached its lowest monthly average in January (20 mm.

Rainy days refer to a day (24-hour period beginning 8 A.M. to A.M. of the next day) in which at least 1 mm of rainfall is recorded (PAGASA 2020). At the project site, the interpolated number of rainy days is generally proportional to the rainfall amount, as shown in **Figure 2-51**. In August, the average rainy day is 19, while in April is two days.

The greatest recorded rainfall at Sangley Point PAGASA Station from 1974 to 2020 was 475.4 mm (**Figure 2-52**). At the Manila PAGASA Station, the highest recorded rainfall was 403.1 m based on rainfall records from 1985 to 2020.

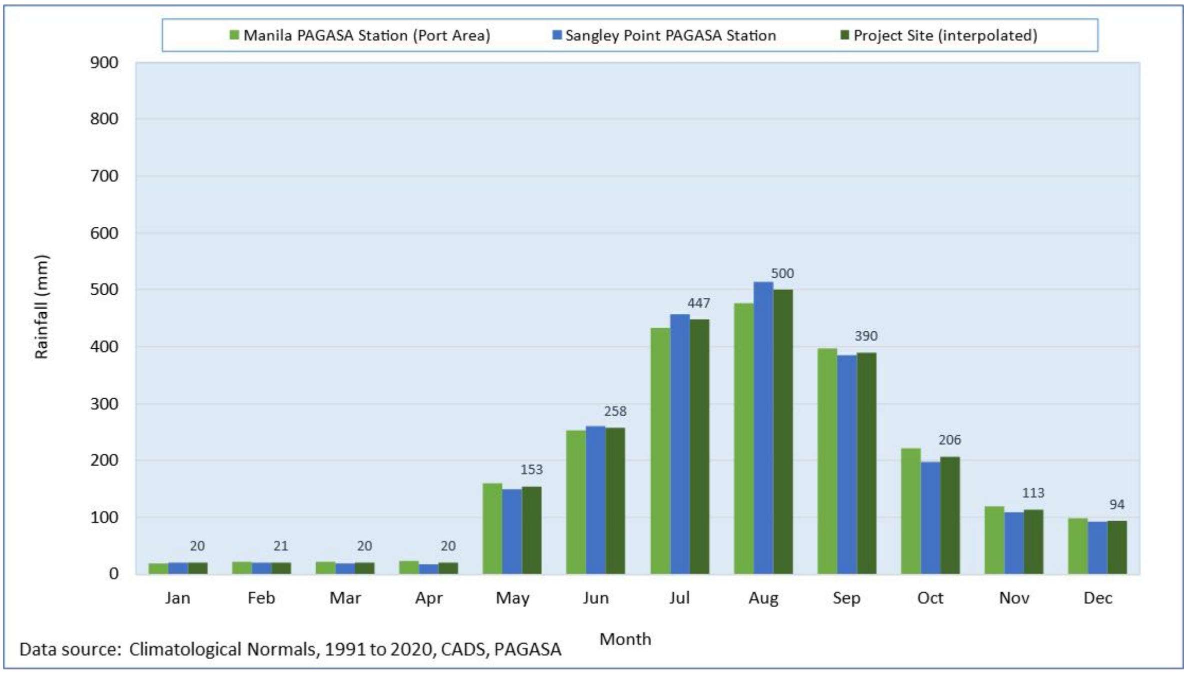


Figure 2-50 Monthly average rainfall at two (2) PAGASA stations and interpolated rainfall at the project site

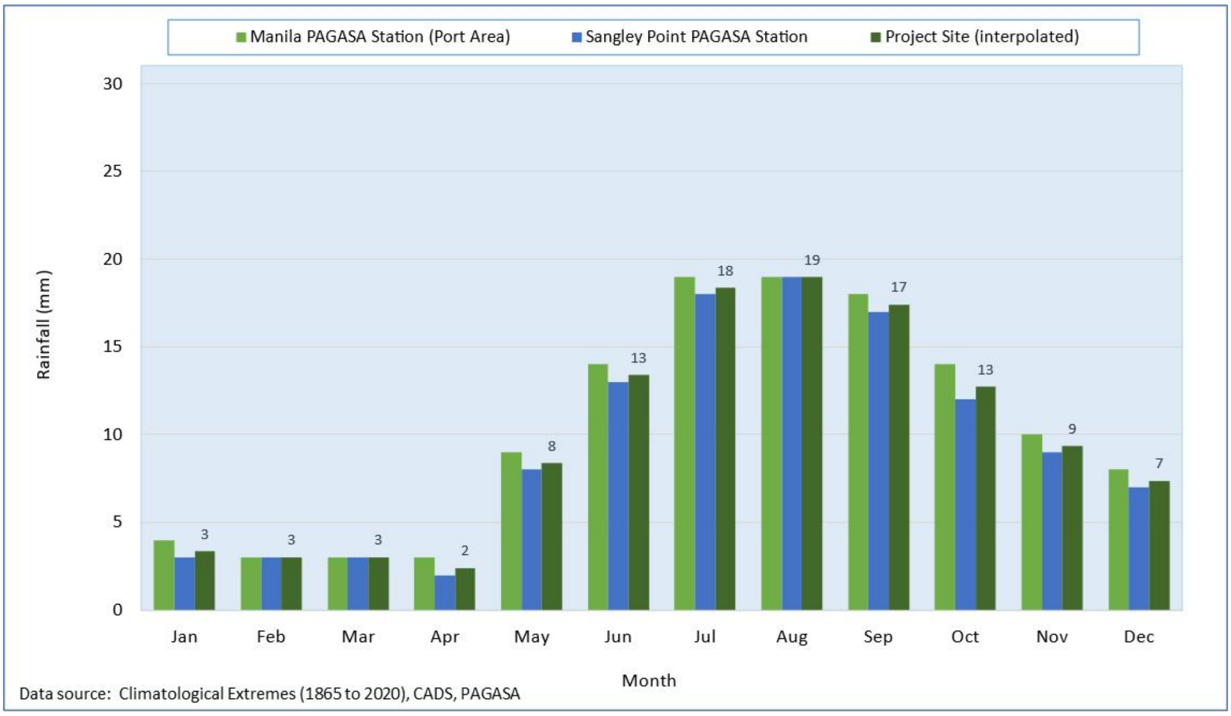
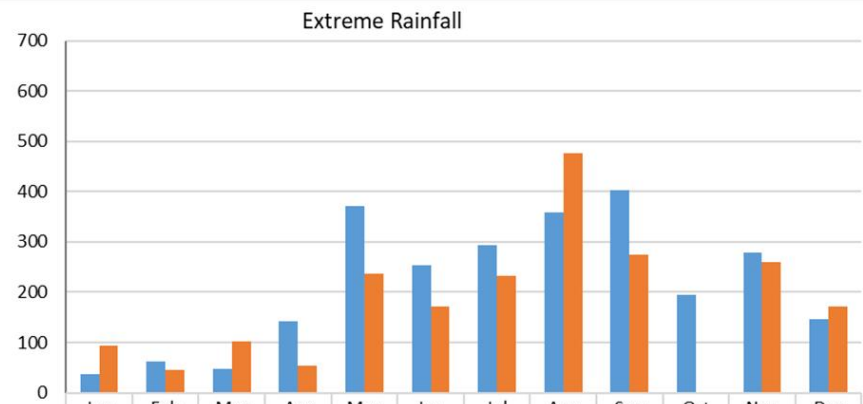


Figure 2-51 Monthly average number of rainy days at two (2) PAGASA stations and interpolated number of rainy days at the project site



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Manila PAGASA Station (Port Area)	37.8	61.3	47.0	143.0	371.4	252.8	293.6	358.0	403.1	194.3	278.4	146.8
Sangley Point PAGASA Station	94.0	45.8	102.2	53.9	237.1	172.4	231.4	475.4	275.4		260.7	171.2

Data source: Climatological Normals, 1991 to 2020, CADS, PAGASA

Figure 2-52 Observed extreme rainfall at two (2) nearby synoptic stations of the PAGASA

Air Temperature

Air temperature shows a downward trend from July to January and an increasing trend from February to June (**Figure 2-53**). On average, the hottest month is June (29.1 ºC), while the coldest month is January (23.9 ºC). The annual average air temperature at the project site is 26.9 ºC.

At the two (2) nearby PAGASA stations, the highest recorded air temperatures were 38.6 ºC and 38.5 ºC in May (**Figure 2-54**), respectively.

The extreme temperature ranges from 34 ºC to 38.5 ºC for Sangley Point PAGASA Station and from 34.6 ºC to 38.6 ºC for the Manila PAGASA Station.

The lowest recorded air temperatures at Sangley Point PAGASA Station and Manila PAGASA Station were 18ºC and 14.5 ºC, respectively (**Figure 2-55**).

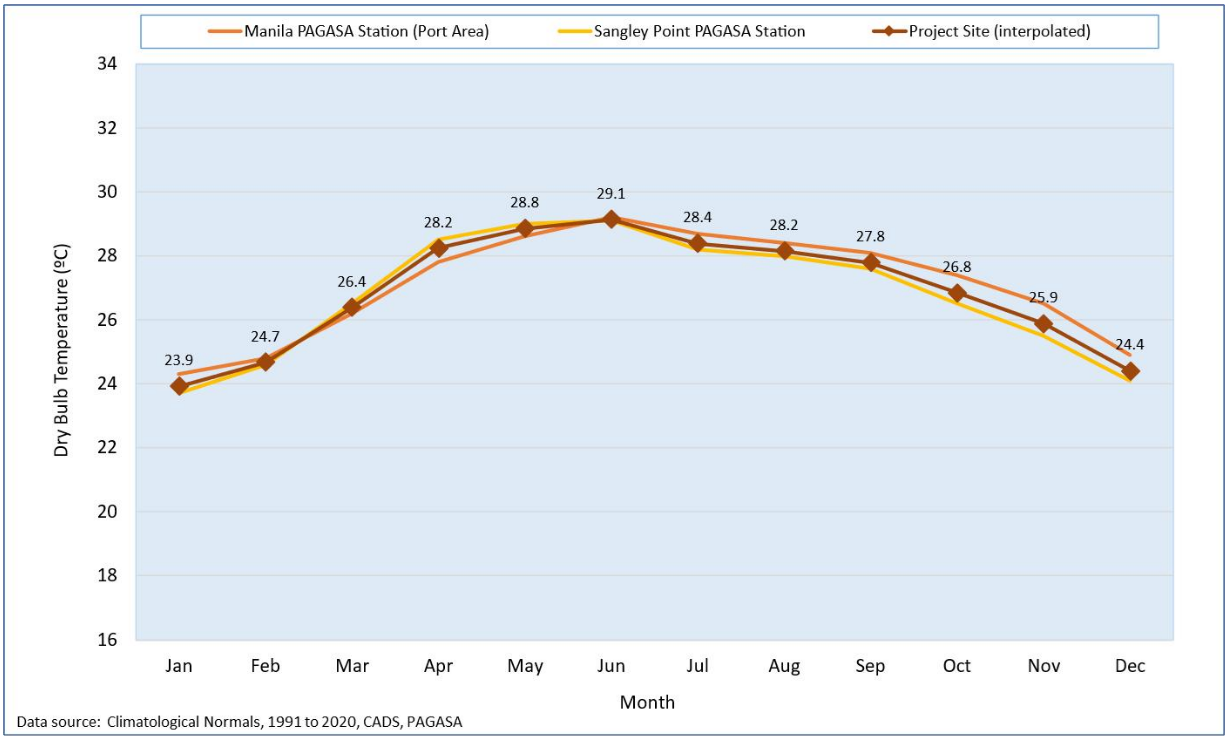


Figure 2-53 Monthly average air temperature at two (2) nearby synoptic stations and interpolated air temperature at the project site

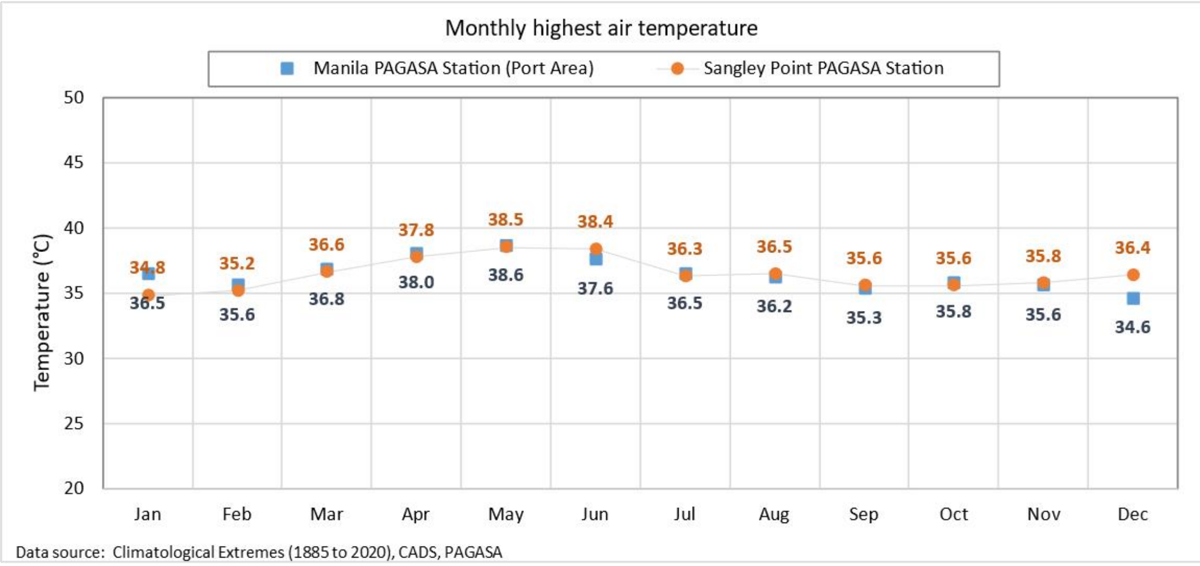


Figure 2- 54 Observed monthly highest air temperature at two (2) nearby synoptic stations of the PAGASA

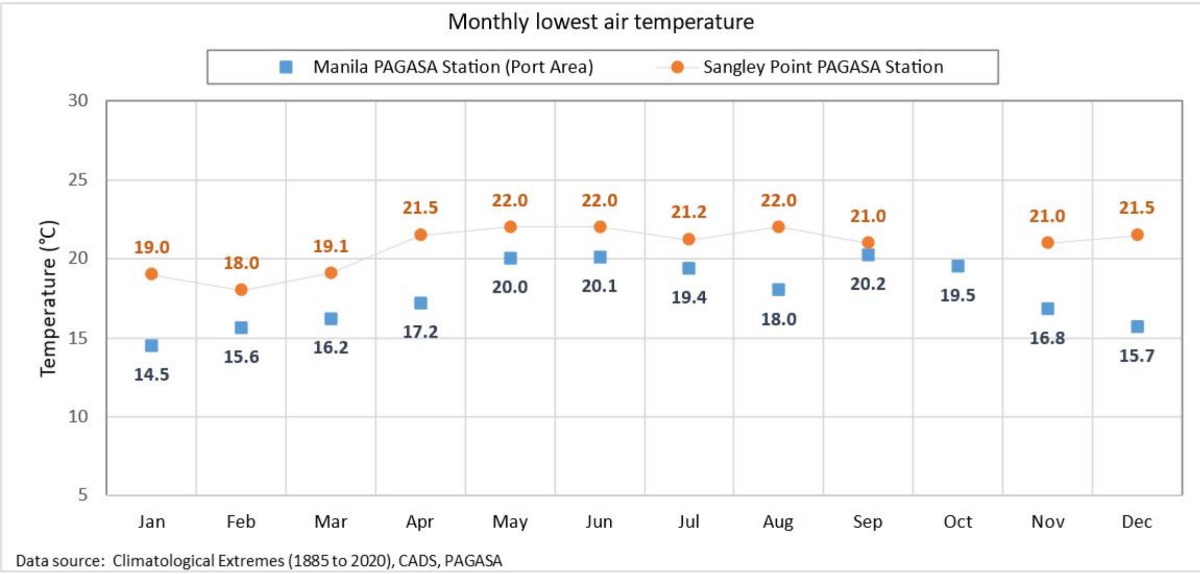


Figure 2- 55 Observed monthly lowest air temperature at two (2) nearby synoptic stations of the PAGASA

Wind Speed and Wind Directions

Figure 2-56 shows the wind rose at Manila PAGASA Station based on wind data from 1981 to 2010. The prevailing wind is from the southwest (15%), followed by winds from the west (10.1%) and from the north (9.5%).

Light winds (1 to 4 m/s) occurred about 93% of the time, while moderate winds (5 to 8 m/s) at 6.3% and fresh winds (8 to 12 m/s) at 0.2%. Calm condition or when wind speed is less than one m/s is not indicated in the wind rose data.

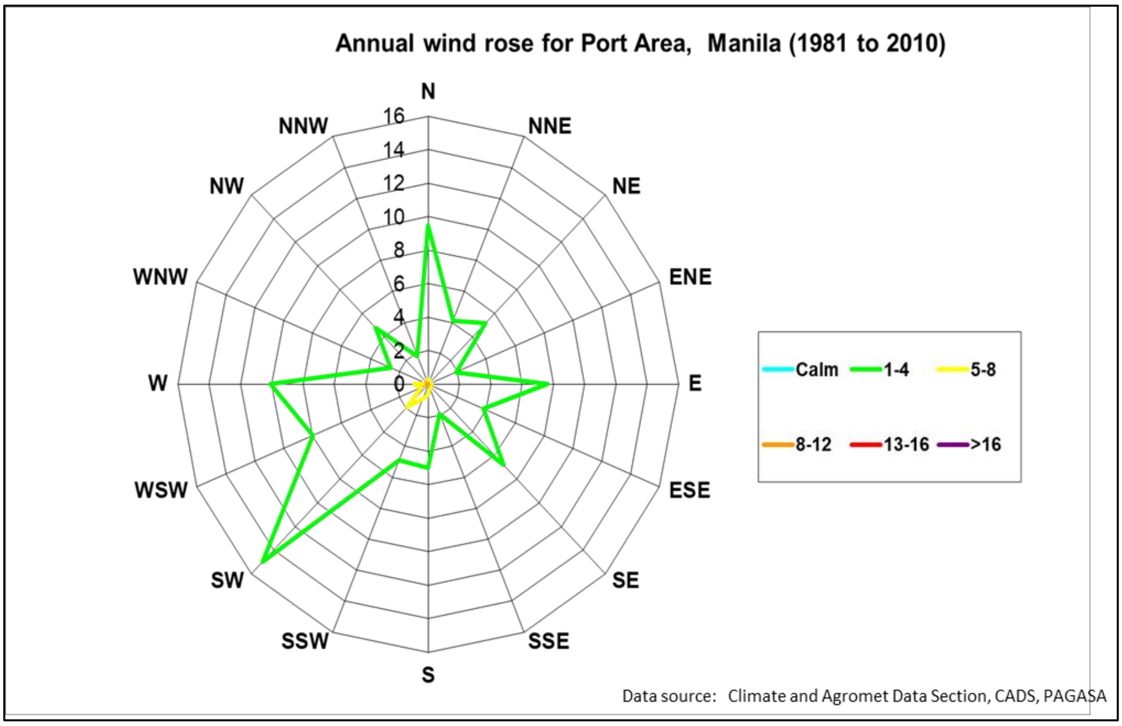


Figure 2-56 Annual wind rose for Manila PAGASA Station (1981 to 2010)

The PAGASA (2015) classified tropical cyclones (TCs) based on associated wind intensity (PAGASA, 2015) (**Table 2-65**).

In the Province of Bataan, there were twenty-seven (27) TCs that crossed the province from 1948 to 2019 (or 71 years) (**Figure 2-57**). About half of these TCs were Typhoon (TY) (48.15%), and the rest were Tropical Storm (TS) (40.74%) and Tropical Depression (TD) (11.11%).

There were no records of Severe Tropical Storm (STS) and Super Typhoon (STY) that crossed the Province of Bataan from 1948 to 2019.

Table 2- 65 Categories of Tropical Cyclones from May 2015 to present

TYPE	SUSTAINED WINDS (KM/H)
Tropical Depression (TD)	<=61
Tropical Storm (TS)	62 to 88
Severe Tropical Storm (STS)	89 to 117
Typhoon (TY)	118 to 220
Super Typhoon (STY)	>220

Source: CADS/CAD/PAGASA

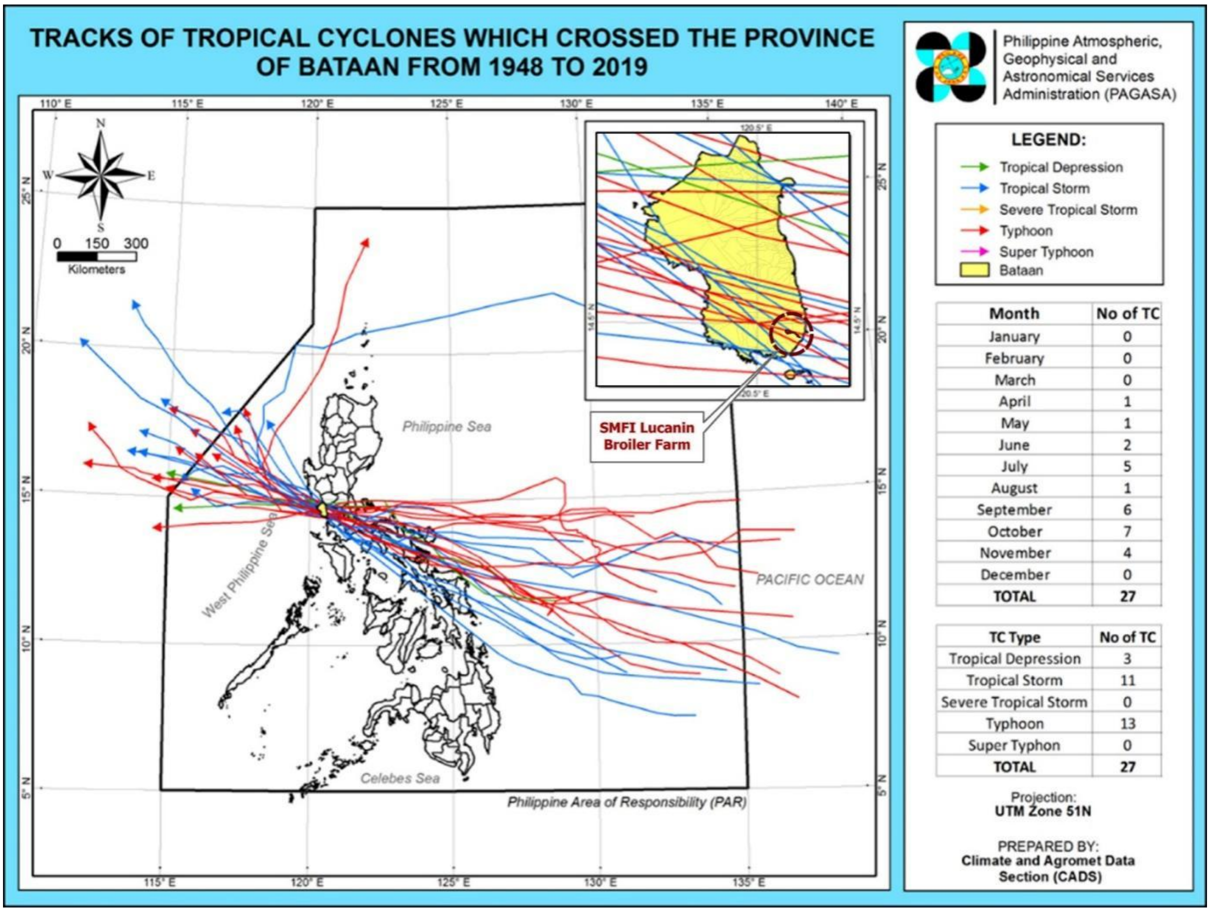


Figure 2- 57 Tracks of Tropical Cyclones which crossed the Province of Bataan from 1948 to 2019

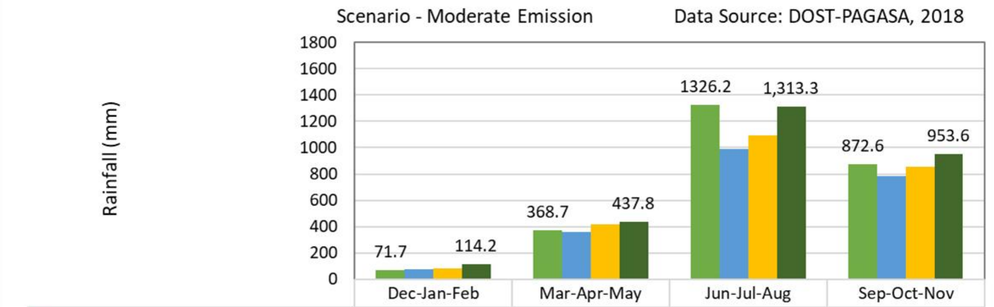
Projected Changes in Climate

Normal Rainfall

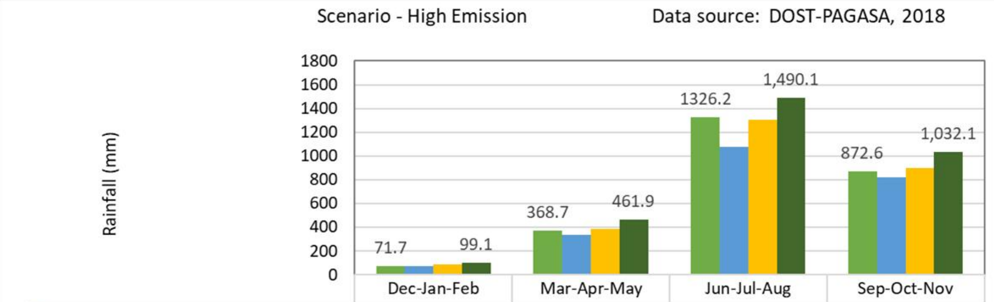
The projected rainfall in the Province of Bataan at moderate emission scenarios shows an increase in Dec-Jan-Feb (northeast monsoon season) and March-April-May, except at lower bound (transition period) from the baseline years (1971 to 2019 at moderate emission scenario (**Figure 2- 58**).

In June-Jul-Aug (southwest monsoon), the projected rainfall amounts were lower than the baseline years. In Sep-Oct-Nov (transition period from southwest monsoon to northeast monsoon season), rainfall amounts appear lower at lower bound and median levels but are greater at upper bound levels.

The projected trend under high emission scenarios appears to be the same as that of the moderate emission scenario.



	Dec-Jan-Feb	Mar-Apr-May	Jun-Jul-Aug	Sep-Oct-Nov
Observed (1971 to 2010)	71.7	368.7	1326.2	872.6
Projected (2036 to 2065) - lower bound	72.4	356.7	988.1	785.0
Projected (2036 to 2065) - median	80.8	413.7	1,091.1	856.0
Projected (2036 to 2065) - Upper bound	114.2	437.8	1,313.3	953.6



	Dec-Jan-Feb	Mar-Apr-May	Jun-Jul-Aug	Sep-Oct-Nov
Observed (1971 to 2010)	71.7	368.7	1326.2	872.6
Projected (2036 to 2065) - lower bound	70.2	333.0	1,074.7	818.6
Projected (2036 to 2065) - median	86.2	385.6	1,301.3	899.3
Projected (2036 to 2065) - Upper bound	99.1	461.9	1,490.1	1,032.1

Figure 2- 58 Projected changes in normal rainfall in the Province of Bataan

Extreme Rainfall

The projected rainfall in the Province of Bataan at moderate emission scenarios shows an increase in Dec-Jan-Feb (northeast monsoon season) and March-April-May, except at lower bound (transition period) from the baseline years (1971 to 2019 at moderate emission scenario (**Figure 2-59**).

In June-Jul-Aug (southwest monsoon), the projected rainfall amounts were lower than the baseline years. In Sep-Oct-Nov (transition period from southwest monsoon to northeast monsoon season), rainfall amounts appear lower at lower bound and median levels but are greater at upper bound levels. The projected trend under high emission scenarios is the same as that of the moderate emission scenario.

In 2020, the DOST-PAGASA, Manila Observatory (MO), and Ateneo de Manila University (ADMU) published the projected extremes of rainfall and air temperature in each province in the Philippines. The projected extreme values are compared with baseline values (1986 to 2005) in the following years.

- Early future – 2020 to 2039,
- Mid-future – 2046 to 2065, and
- Late future – 2080 to 2099

Table 2-66 presents the summary of the projected extremes of rainfall in the Province of Bataan. There appears to be no consistent trend on the projected extreme rainfall amount in the early, mid, and late future under moderate and high emission scenarios. For example, there are projected increases in the early and late future, but the opposite in the mid-future. The trend also depends on the degree of increase in CO2 emissions (moderate and high emissions)

Table 2-66 Projected extremes of rainfall (Data source: DOST-PAGASA, MO, and ADMU, 2020)

DESCRIPTION	UNIT	DEFINITION (BASED ON DOST-PAGASA, MO, AND ADMU, 2020)	TREND ON PROJECTED EXTREME AS REFERRED FROM THE BASELINE YEARS		REFERENCE FIGURE
			MODERATE EMISSION SCENARIO	HIGH EMISSION SCENARIO	
Total wet daily rainfall	mm	Total daily rainfall greater the 95th percentile received during wet days, when at least 1 mm of daily rainfall is recorded within the year	Decrease in early and late future; increase in mid-future	Same trend as moderate emission scenario	Figure 2-59
Average daily rainfall intensity	mm/day	Indicates typical amount of rainfall during wet days.	No change in early and mid-future; decrease in	Same trend as moderate emission scenario	Figure 2-60

DESCRIPTION	UNIT	DEFINITION (BASED ON DOST-PAGASA, MO, AND ADMU, 2020)	TREND ON PROJECTED EXTREME AS REFERRED FROM THE BASELINE YEARS		REFERENCE FIGURE
			late future		
Minimum 1-day rainfall total	mm	Maximum amount of rain that can falls in 1 day	Decrease in early future; increase in mid- and late future	Increase in all future scenarios	Figure 2-60
Maximum 5-day rainfall total	mm	Maximum amount of rainfall that falls over a period of five (5) consecutive days	Decrease in early future; increase in mid- and late future	Decrease in early and late future; increase in mid-future	Figure 2-60
Number of very wet days	days	Number of days when daily rainfall > 95^{th} percentile	Increase in early and mid-future; no change in late future	Decrease in all future	Figure 2-61
Number of extremely wet days	days	Number of days when daily rainfall > 98^{th} percentile	Decrease in early and late future; increase in mid-future	No change in early future; increase in mid-future; decrease in late future	Figure 2-61
Longest wet spell	days	Consecutive wet days; maximum number of consecutive days when rainfall >= 1 mm	Decrease in early and late future; slight increase in mid- future	Decrease in early and mid-future; slight increase in late future	Figure 2-62
Longest dry spell	days	Consecutive dry days; maximum number of consecutive days when rainfall < 1 mm	Decrease in early and mid-future; increase in late future	Decrease in all future scenarios	Figure 2-62

Figure 2- 59 Projected total wet-day rainfall under moderate (top) and high emission scenarios (bottom)

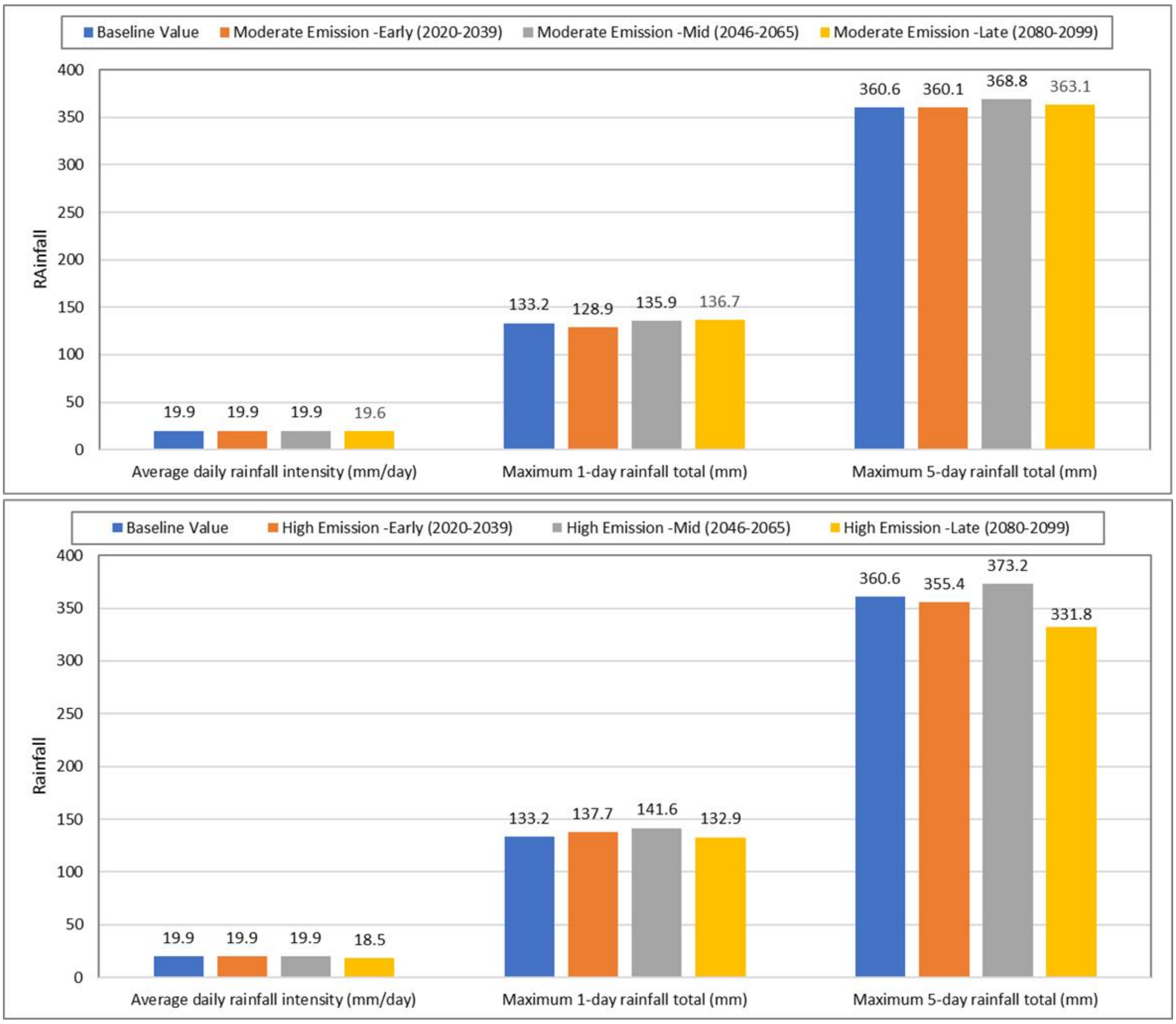
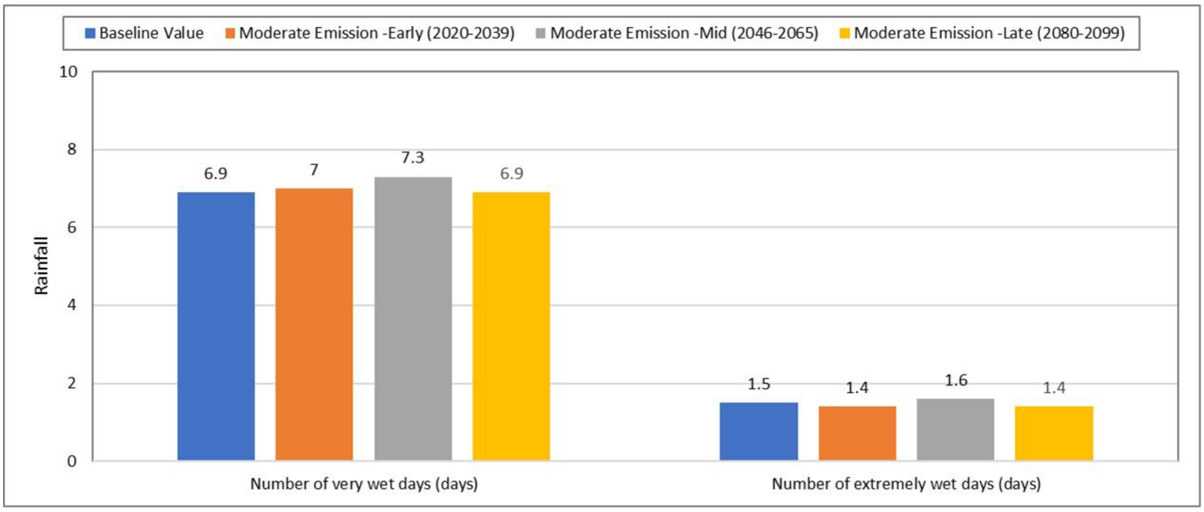


Figure 2- 60 Projected average daily rainfall intensity, maximum 1-day rainfall, and maximum 5-day rainfall under moderate (top) and high emission scenarios (bottom



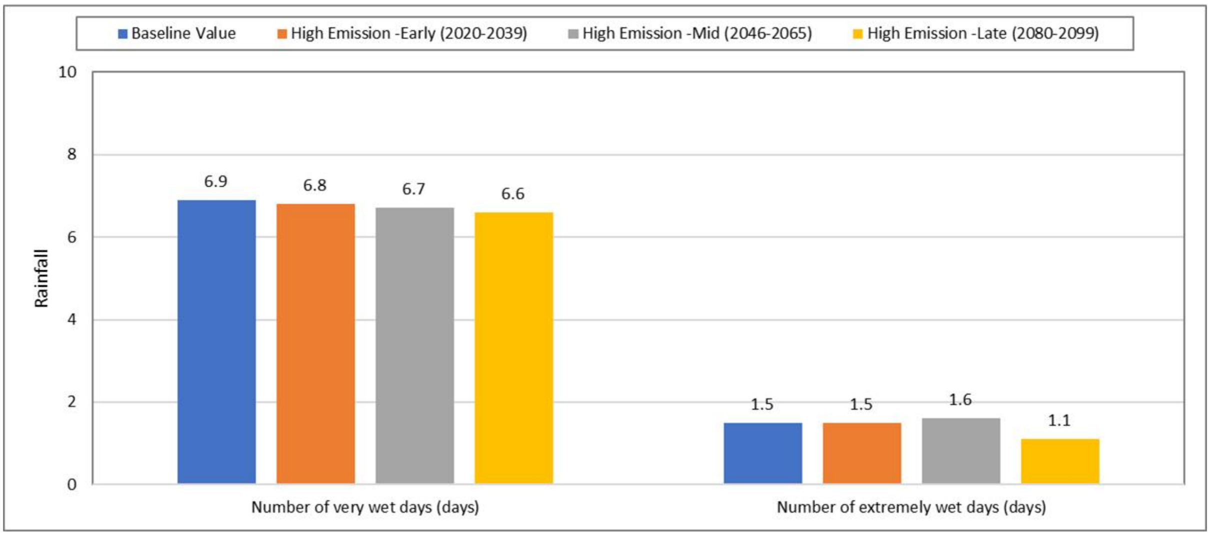
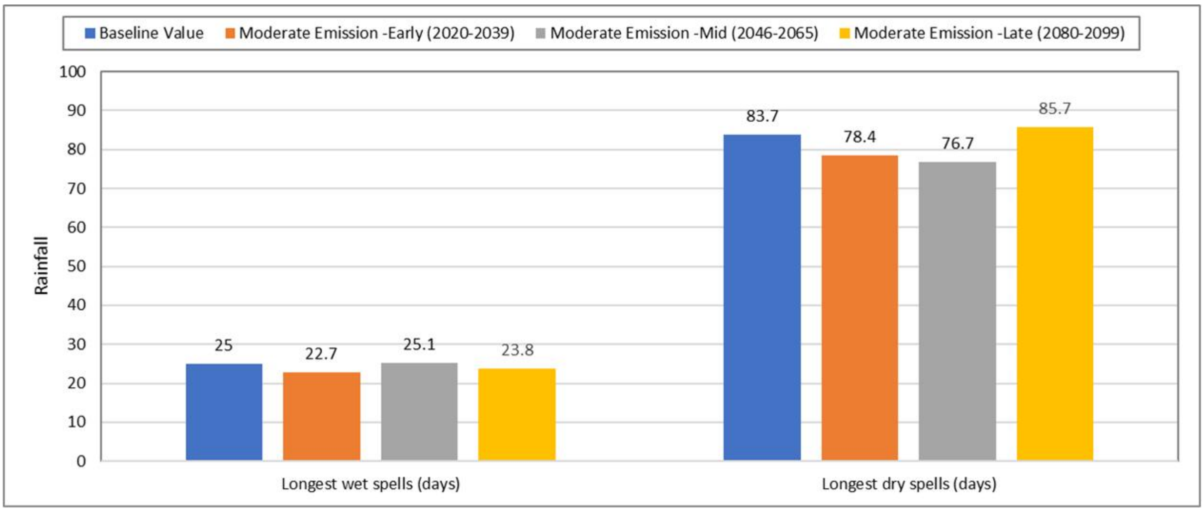


Figure 2- 61 Projected number of very wet days and number of extremely wet days under moderate (top) and high emission scenarios (bottom)



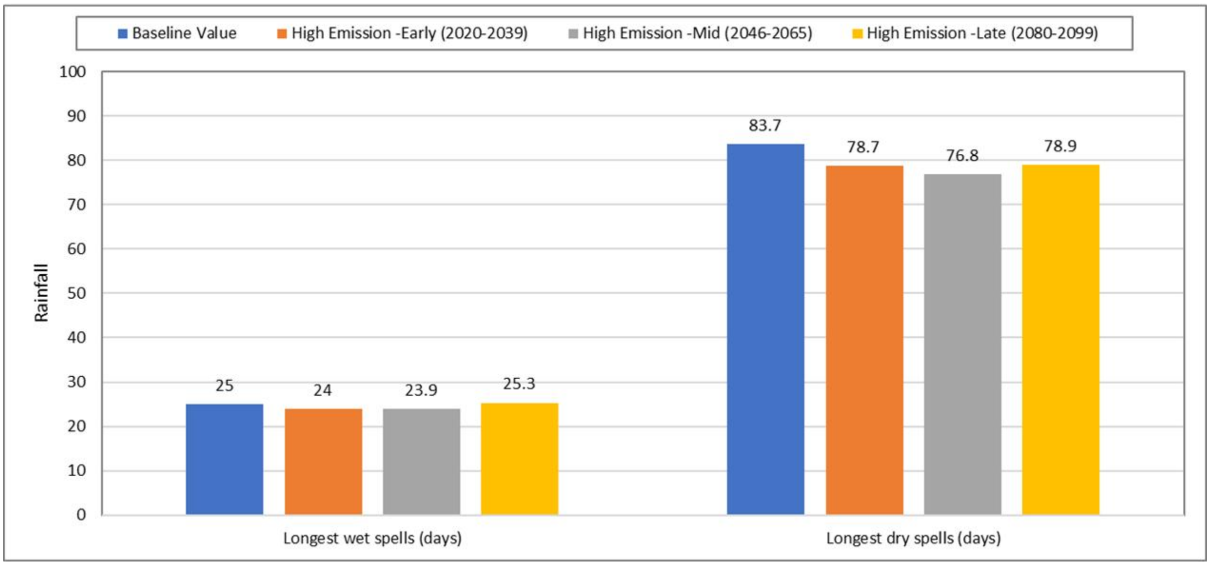
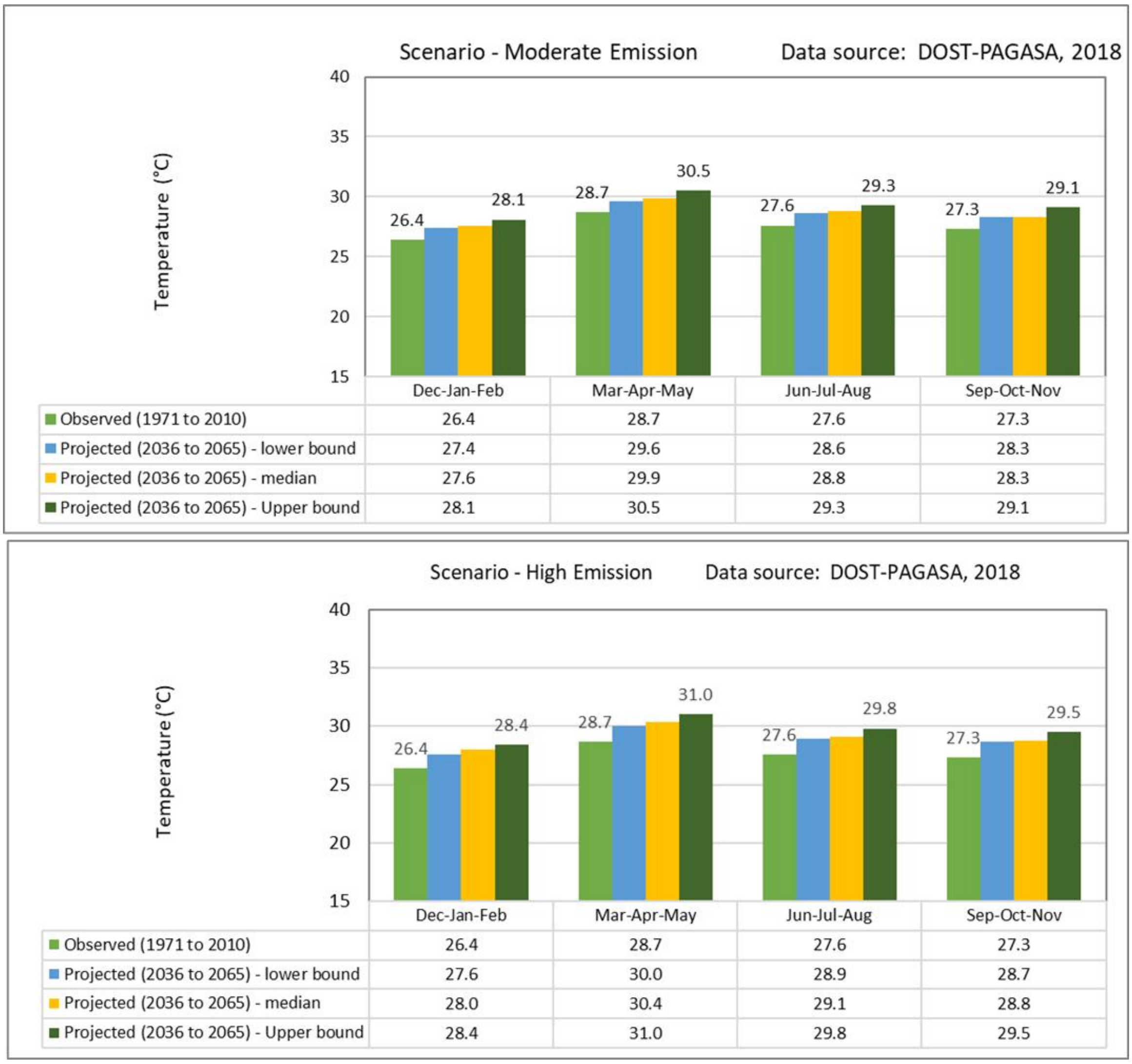


Figure 2-62 Projected longest wet spells and longest dry spells under moderate (top) and high emission scenarios (bottom)

Air Temperature

In the Province of Bataan, there are projected increases in air temperature in all periods under moderate and high emission scenarios (**Figure 2-63**). This is consistent with the observed and projected increase in air temperature in the Philippines (DOST-PAGASA, 2018).

The projected air temperature extremes increase in all future under moderate and high emission scenarios (**Table 2-67** and **Figure 2-64** to **Figure 2-66**). Most alarming is the increase of the warm spell duration index in all future scenarios (early, mid-, and late) from 10.8 days (baseline years) to as high as 365 days (1 year) mid and late future under moderate and high emission scenarios



	Dec-Jan-Feb	Mar-Apr-May	Jun-Jul-Aug	Sep-Oct-Nov
Observed (1971 to 2010)	26.4	28.7	27.6	27.3
Projected (2036 to 2065) - lower bound	27.4	29.6	28.6	28.3
Projected (2036 to 2065) - median	27.6	29.9	28.8	28.3
Projected (2036 to 2065) - Upper bound	28.1	30.5	29.3	29.1

	Dec-Jan-Feb	Mar-Apr-May	Jun-Jul-Aug	Sep-Oct-Nov
Observed (1971 to 2010)	26.4	28.7	27.6	27.3
Projected (2036 to 2065) - lower bound	27.6	30.0	28.9	28.7
Projected (2036 to 2065) - median	28.0	30.4	29.1	28.8
Projected (2036 to 2065) - Upper bound	28.4	31.0	29.8	29.5

Figure 2- 63 Projected changes in normal air temperature under moderate (top) and high emission scenarios (bottom)

Table 2-67 Projected changes of extreme air temperature in the Province of Bataan

DESCRIPTION	UNIT	DEFINITION*	MODERATE EMISSION SCENARIO	HIGH EMISSION SCENARIO	REFERENCE FIGURE
Coldest night time temperature	°C	Indicates the temperature that may be expected on the coldest night of the year	Increase in all future scenarios	Increase in all future scenarios	Figure 2-64
Average night time temperature	°C	Average night time temperature within the year	Increase in all future scenarios	Increase in all future scenarios	Figure 2-64
Warmest night time temperature	°C	Warmest night time temperature of the year	Increase in all future scenarios	Increase in all future scenarios	Figure 2-64
Coldest day time temperature	°C	Lowest daytime temperature for each year	Increase in all future scenarios	Increase in all future scenarios	Figure 2-65
Average day time temperature	°C	Average daytime temperature	Increase in all future scenarios	Increase in all future scenarios	Figure 2-65
Warmest day time temperature	°C	Temperature on the hottest day of the year	Increase in all future scenarios	Increase in all future scenarios	Figure 2-65
Warm Spell Duration Index	days	Indicates the number of days contributing to warm periods. A warm spell occurs when the daily maximum temperature for six or more consecutive days exceeds the 90th percentile threshold of the baseline.	Increase in all future scenarios	Increase in all future scenarios	Figure 2-66

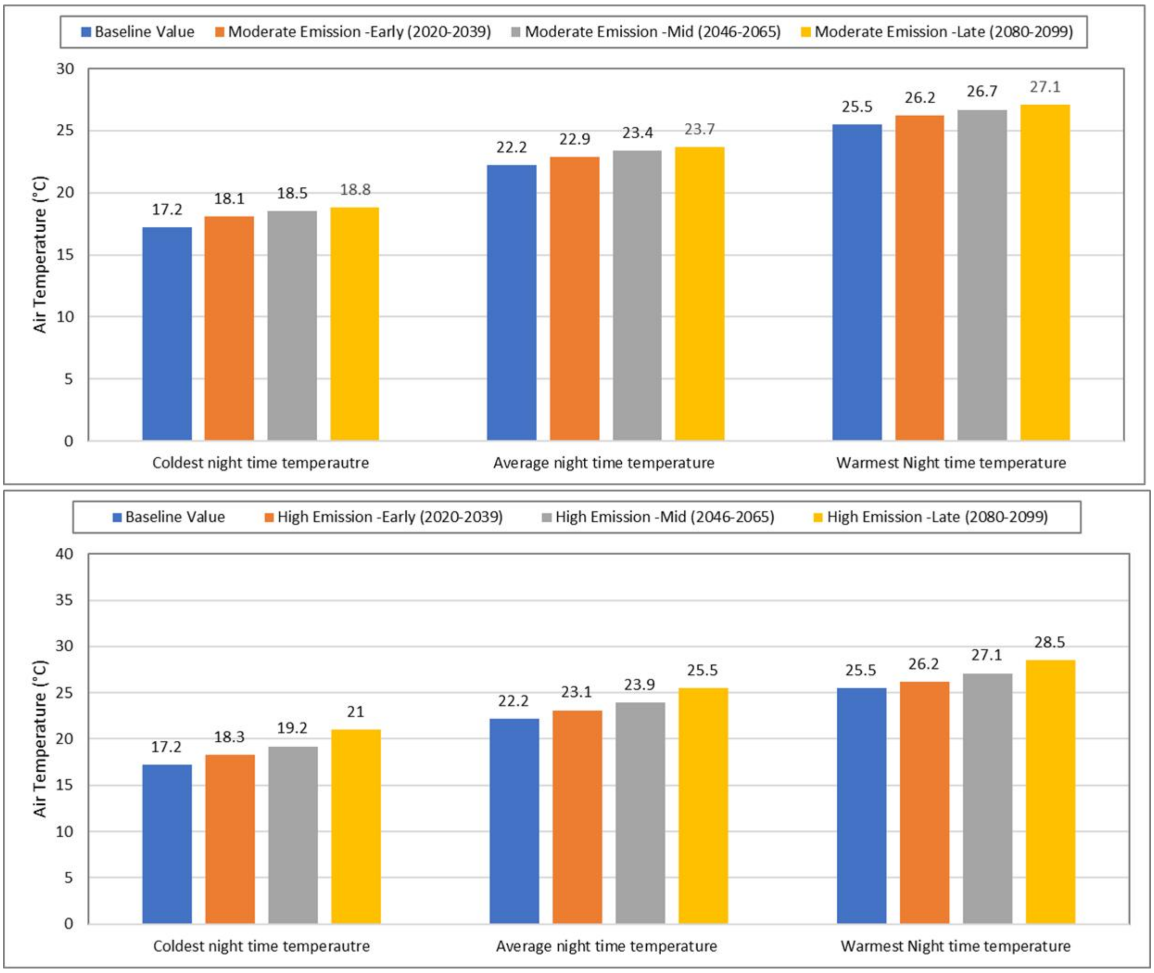


Figure 2- 64 Projected coldest night time temperature, average night time temperature, and warmest night time temperature under moderate (top) and high emission scenarios (bottom)

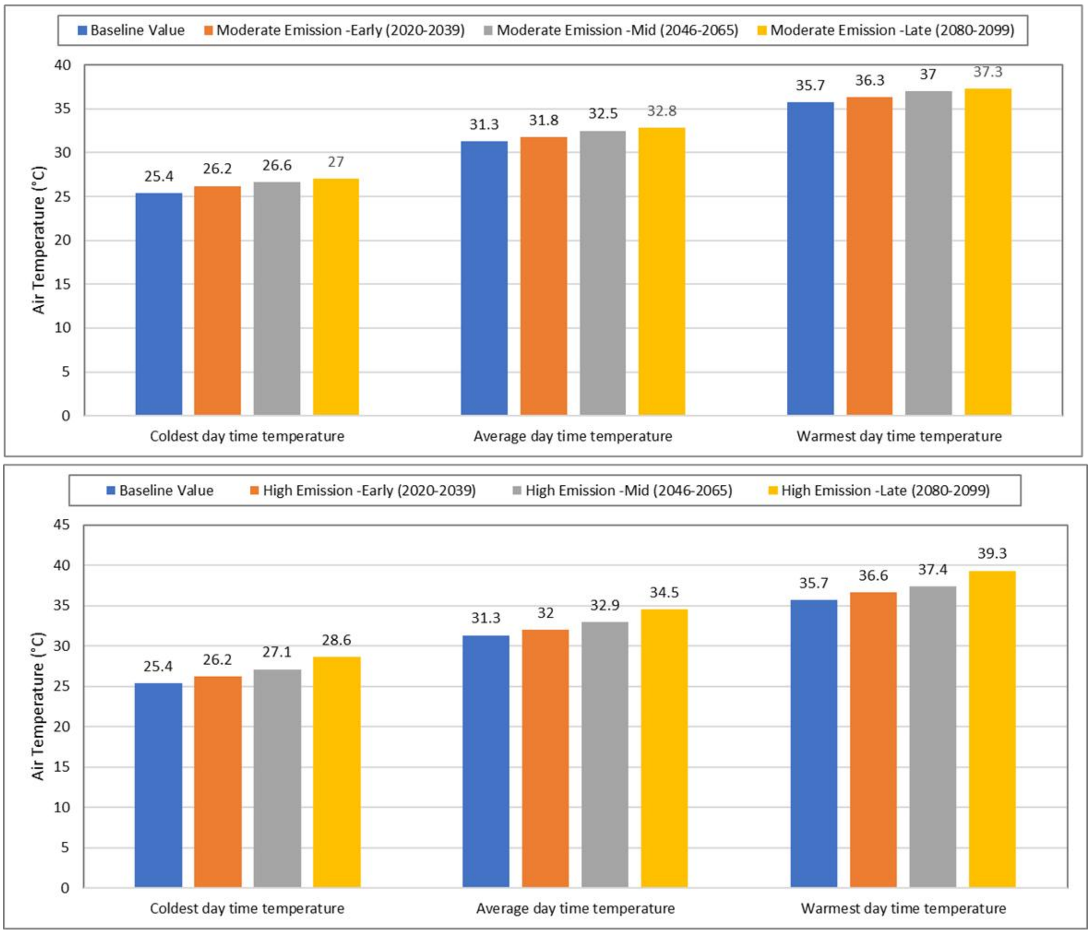


Figure 2- 65 Projected coldest day temperature, average day time temperature, and warmest day time temperature under moderate (top) and high emission scenarios (bottom)

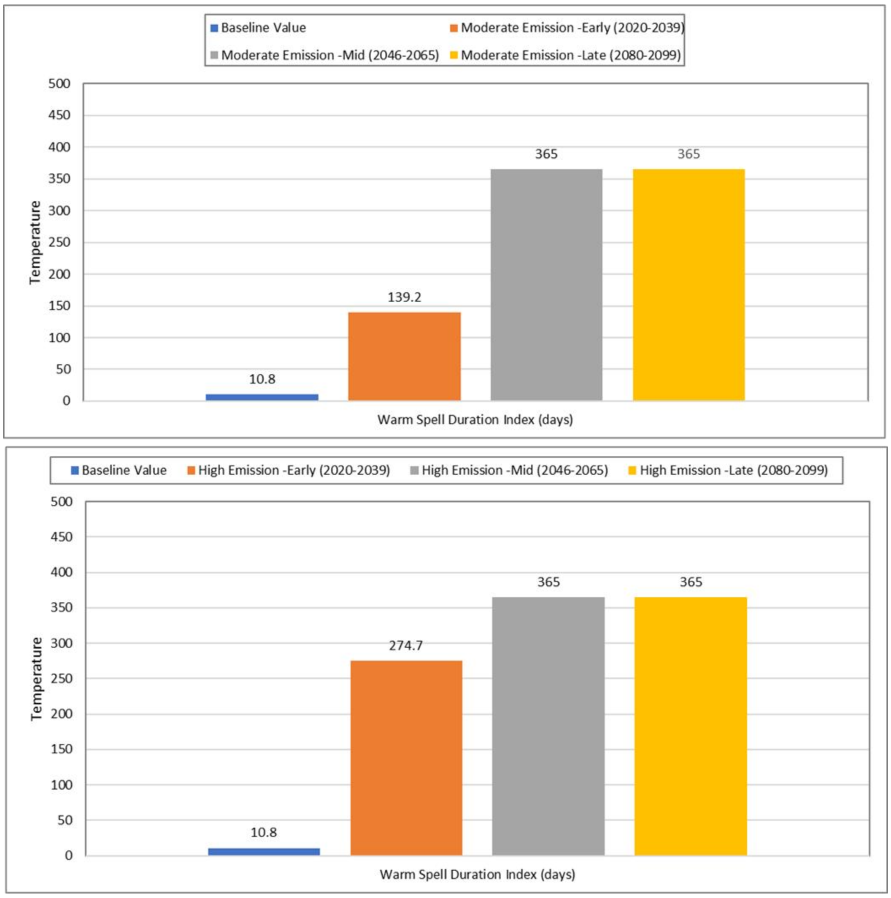


Figure 2-66 Projected warm spell duration index under moderate (top) and high emission scenarios (bottom)

2.4.2 Ambient Air and Noise Quality

2.4.2.1 Ambient Air Quality

This section presents the results of the baseline air quality monitoring conducted in the vicinities of the project site in July 2022 and the assessment of impacts of the projects on the existing air quality by air dispersion modelling.

2.4.2.1.1 Methodology

Background Air Quality Monitoring

Air quality data presented in this report were based on air monitoring in November 2021 and February 2023. In November 2021 sampling, monitoring was performed at six (6) locations (**Table 2-68** and **Figure 2-67**Error! Reference source not found.).Monitoring was conducted for TSP, PM_{10}, SO_2, and

NO_2 at an averaging period of 24 hours per station. The photographs of the air samplers at the sampling stations are shown in **Plate 2-28** to **Plate 2-30**.

In February 2023 sampling, the air pollutants sampled were particulates (PM_{10}, $PM_{2.5}$), gaseous (SO2, NO2, and CO), and particulate metals (Zn, Pb, Hg, Cu, Cd, As, Ni). Monitoring was conducted at four (4) locations by ACES Distribution and Consulting Services, Inc. (ACES). The photographs of the air samplers at the sampling stations are shown in **Plate 2-31** to **Plate 2-34**.

Table 2-68 shows the methods and analysis provided by ACES (2023). Equipment used during monitoring in February 2023 is as follows:

- Staplex Model TFIA-2 High Volume Sampler – for particulates and metals,
- Kimoto Model HS-7 Handy sampler – for SO_2 and NO_2,
- PMS200 Automatic Particulate Matter Sampler (PM10) – for PM_{10}, and
- Detcon Multirae Lite – for CO

Annex 10 presents the calibration certificates of the above-mentioned air samplers.

Table 2-69 present the methods of air sampling and analysis. Brief discussion on the methods of sampling and analysis were based from ACES (2023).

Table 2-68 Coordinates, date of sampling, and air pollutants monitored during air sampling in November 2021 and February 2023

STATION ID	LOCATION	GEOGRAPHICAL COORDINATES	DATE/TIME OF SAMPLING	AVERAGING TIME	AIR POLLUTANTS MONITORED
AQ1-2021	Near Villa Imperial residences	14°28'4.34"N 120°35'49.61"E	November 14-15,2021/ 10:16 AM-10:16 AM	24 hours	TSP, PM_{10}, SO_2, NO_2
AQ2-2021	Sitio Maligaya	14°28'1.42"N 120°35'10.46"E	November 15-16,2021 / 10:23AM-10:23 AM	24 hours	TSP, PM_{10}, SO_2, NO_2
AQ3-2021	Near Barangay Alion	14°28'58.88"N 120°34'11.43"E	November 11-12,2021 / 9:00 AM-9:00 AM	24 hours	TSP, PM_{10}, SO_2, NO_2
AQ4-2021	Near Alion Barangay Hall	14°29'28.00"N 120°34'50.00"E	November 13-14,2021 /9:40 AM-9:40 AM	24 hours	TSP, PM_{10}, SO_2, NO_2
AQ5-2021	Near residential area in Barangay Mountain View	14°27'15.00"N 120°34'39.00"E	November 16-17,2021 / 10:30 AM-10:30 AM	24 hours	TSP, PM_{10}, SO_2, NO_2
AQ6-2021	Near Sitio Paliparan, Barangay	14°29'1.00"N 120°35'52.00"E	November 12-13,2021 / 9:30 AM-9:30 AM	24 hours	TSP, PM_{10}, SO_2, NO_2

STATION ID	LOCATION	GEOGRAPHICAL COORDINATES	DATE/TIME OF SAMPLING	AVERAGING TIME	AIR POLLUTANTS MONITORED
	Bataan II				
AQ1	Sitio Ingles Stalion	14°28'47.90"N 120°33'56.55"E	February 7-8, 2023/ 9:30 A.M.-9:30 A.M.	24 hours	PM_{10}, $PM_{2.5}$, SO_2, NO_2,CO, Zn, Pb, Hg, Cu, Cd, As, Ni
AQ2	Sitio Iningles Near Town Site	14°28'31.47"N 120°34'4.75"E	February 8- 9, 2023/ 9:40 A.M. – 9:40 A.M.	24 hours	PM_{10}, $PM_{2.5}$, SO_2, NO_2,CO, Zn, Pb, Hg, Cu, Cd, As, Ni
AQ3	Alion Crossing	14°29'23.68"N 120°34'17.00"E	February 9-10, 2023/ 10:00 A.M.–10:00 A.M.	24 hours	PM_{10}, $PM_{2.5}$, SO_2, NO_2,CO, Zn, Pb, Hg, Cu, Cd, As, Ni
AQ4	Alion Manggahan St.	14°29'19.56"N 120°34'47.78"E	February 10-11, 2023/ 10:10- A.M.-10:00 A.M	24 hours	PM_{10}, $PM_{2.5}$, SO_2, NO_2,CO, Zn, Pb, Hg, Cu, Cd, As, Ni

Note: Sampling stations AQ1 to AQ6 in November 2021 are renamed in this report as AQ1-2021 to AQ6-2021

Table 2- 69 Methods of air sampling and analysis

PARAMETERS	PARAMETERS
Particulate Matter 10 (PM_{10})	High Volume – Gravimetric Method
Particulate Matter 2.5 ($PM_{2.5}$)	High Volume – Gravimetric Method
Nitrogen Dioxide (NO_2)	Impinger Bubbler – Griess-Saltzman Reaction Method
Sulfur Dioxide (SO_2)	Impinger Bubbler-Pararosaniline Colorimetric Method
Carbon Monoxide (CO)	Direct Reading-MultiRAE
Zinc (Zn)	High Volume – ICP-OES
Particulate Lead (Pb)	High Volume – ICP-OES
Mercury (Hg)	High Volume – Manual Cold Vapor AAS
Copper (Cu)	High Volume – ICP-OES
Cadmium (Cd)	High Volume – ICP-OES
Arsenic (As)	High Volume – ICP-OES
Nickel (Ni)	High Volume – ICP-OES

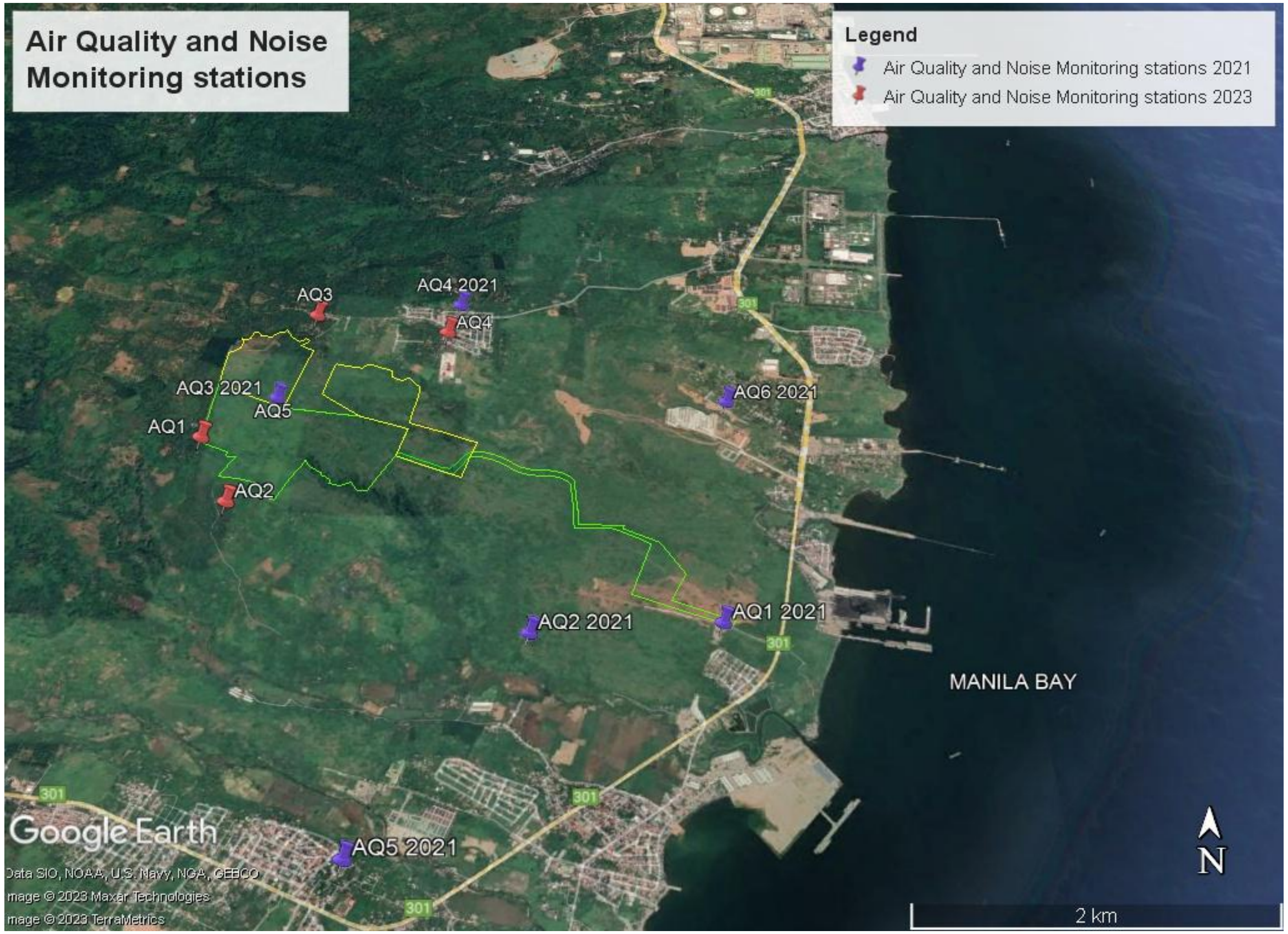


Figure 2- 67 Air Quality Sampling Stations

Station ID	Photos		Observations	Geographical Coordinates
	Ambient Air	Ambient Noise		
AQ1 Near Villa Imperial Residences			Sampling station is located in near residential area. Approximately 60meters form the main road. Continuous passing of vehicles was observed during sampling.	14°28'4.34"N 120°35'49.61"E
AQ2 Sitio Maligaya			The monitoring station is located near the residential area of Sitio Maligaya. Occasionally passing of tricycles and motorcycles were observed.	14°28'1.42"N 120°35'10.46"E

Plate 2-28 Air and noise monitoring at Stations AQ1-2021 and AQ2-2021 in November 2021

Station ID	Photos		Observations	Geographical Coordinates
	Ambient Air	Ambient Noise		
AQ3 Near Barangay Alion			The monitoring station is located at a grassy and open area near Brgy. Alion. Occasionally passing tricycles and carabaos were observed near the station.	14°28'58.88"N 120°34'11.43"E
AQ4 Near Alion Barangay Hall			The monitoring station is located area near Alion Barangay Hall. Occasionally passing of light to medium-sized vehicles were observed near the station.	14°29'28.00"N 120°34'50.00"E

Plate 2-29 Air and noise monitoring at Stations AQ3-2021 and AQ4-2021 in November 2021

Station ID	Photos		Observations	Geographical Coordinates
	Ambient Air	Ambient Noise		
AQ5 Near Residential area in Barangay Mountain View			Sampling monitoring station is located along residential area of Barangay Mt. View. Grass cutting activities and children playing during sampling was observed near the station.	14°27'15.00"N 120°34'39.00"E
AQ6 Near Sitio Paliparan, Barangay Bataan II			The monitoring station is located in Sitio Paliparan Barangay Batangas II. Children playing were observed near the sampling station.	14°28'45.77"N 120°35'7.43"E

Plate 2- 30 Air and noise monitoring at Stations AQ5-2021 and AQ6-2021in November 2021

Plate 2- 31 Air quality monitoring at Station AQ1 in February 2023

Plate 2- 32 Air quality monitoring at Station AQ2 in February 2023

Plate 2- 33 Air quality monitoring at Station AQ3 in February 2023

Plate 2- 34 Air quality monitoring at Station AQ4 in February 2023

PM_{10}

Sampling of PM_{10} was carried out by using a high-volume PM_{10} sampler. Ambient air was drawn at a controlled flow rate into a specially-shaped cyclone inlet where the larger particulates are inertially separated from the PM_{10} size range. Each size fraction in the PM_{10} size range is then collected on a pre-weighed glass microfiber filter over the specified sampling period. The filter paper with retained particles was recovered after sampling and desiccated for 24 hours in the laboratory, followed by accurate weighing using a calibrated mass balance. The net weight (mass gain) from the initial and final masses of the filter paper corresponds to the amount of PM_{10} collected. The concentration of PM_{10} in ambient air was determined from the ratio of total mass of PM_{10} collected and the total normal volume of air sampled.

$PM_{2.5}$

Sampling of $PM_{2.5}$ was carried out by using a high-volume $PM_{2.5}$ sampler. Ambient air was drawn at a controlled flow rate into a specially-shaped cyclone inlet where the larger particulates are initially separated from the $PM_{2.5}$ size range. Each size fraction in the $PM_{2.5}$ size range is then collected on a pre-weighed glass microfiber filter over the specified sampling period. The filter paper with retained particles was recovered after sampling and desiccated for 24 hours in the laboratory, followed by accurate weighing using a calibrated mass balance. The net weight (mass gain) from the initial and final masses of the filter paper corresponds to the amount of $PM_{2.5}$ collected. The concentration of $PM_{2.5}$ in ambient air was determined from the ratio of the total mass of $PM_{2.5}$ and the total normal volume of air sampled.

Particulate Lead, Arsenic, Cadmium, Zinc, Nickel and Copper

The method of sampling for lead (Pb), Arsenic (As), Cadmium (Cd), Zinc (Zn), Nickel (Ni) and Copper (Cu) were the use of a high-volume sampler. Air was drawn through a desiccated filter paper to collect the pollutant. The particulate metals were determined by the use of an Inductively Couple Plasma-Optical Emission Spectroscopy (ICP-OES). The masses are divided by the total normal volume of air sampled to obtain the concentrations of each metal.

SO_2

Sulfur dioxide in the ambient air was sampled using a handy gas sampler by aspirating air at a controlled flowrate into a solution of 0.04 M sodium tetrachloromercurate (TCM) through a glass midget impinger over the specified sampling period. The solution was then treated in the laboratory with formaldehyde and with a specially purified acid-bleached pararosaniline to form an intensely colored pararosaniline methyl sulfonic acid. The color intensity was measured spectrophotometrically at 548 nm and is directly related to the amount of SO_2 collected. SO_2 concentration was determined from the difference between the absorbance of the sample and blank, multiplied by the calibration factor, and divided by the total normal volume of air sampled.

NO_2

Nitrogen dioxide in the ambient air was determined using Griess-Saltzman Reaction Method. Air was drawn using a handy gas sampler at a controlled flow rate into an azo-dye forming reagent through a glass midget impinger over a specified sampling period. The absorption reaction produces a stable red-violet color. The color intensity was read by a spectrophotometer in a laboratory at 550 nm and is directly related to the amount of NO_2 collected. NO_2 concentration was determined from the difference between the absorbance of the sample and blank, multiplied by the calibration factor, and divided by the total normal volume of air sampled.

Mercury

The method of sampling for Mercury (Hg) was done using the high-volume sampler. Air was drawn through a desiccated filter paper to collect the pollutant. The particulate metals were determined by the use of Manual Cold Vapor AAS. The determined mass was divided by the total normal volume of air sampled to obtain the concentrations of the particulate mercury.

Total Hydrocarbons as CO

Carbon monoxide in ambient air was measured using a Multi RAE monitor; ambient air was drawn in the analyzer by a peristaltic pump and analyzed using a fast response electrochemical sensor. Electronic signals are produced and converted into concentration presented in ppm.

Background Air Quality

Table 2-70 Table 2-73shows the ambient air monitoring results at six (6) locations in November 2021. TSP PM10 levels ranged from 24.9 to 68.1 µg/Nm3 and 12.4 to 23.6 µg/Nm^3, respectively. PM_{10} levels in February 2023 ranged from 9.7 to 31 µg/Nm^3 (**Table 2-71**). These concentrations were within the ambient guideline values set for TSP and PM_{10} at 230 and 150 µg/Nm^3, respectively.

The measured ambient SO_2 and NO_2 concentrations air concentrations in the November 2021 and February 2023 sampling were all less than the ambient guideline values set at 180 and 150 µg/Nm^3, respectively.

Ambient air concentrations of particulate metals (As, Cd, and Ni) were not detected in the February 2023 sampling (**Table 2-72).** There were traces, however, of Zn (0.06 to 0.7 µg/Nm^3), Hg (0.002 to

0.006 μg/Nm^3), and 0.13 to 0.26 μg/Nm^3 (**Table 2-73**). Levels of Hg were all less than the guideline value of 1 μg/m^3 (annual average) for inorganic Hg vapor (WHO, 2000).

In terms of the air quality indices (AQI) established by the DENR, levels of TSP, PM_{10}, $PM_{2.5}$, SO_2, and CO in the area were all in "good condition" at the time of monitoring (**Table 2-74**).

Table 2-70 Measured concentrations of air pollutants in November 2021

STATION	LOCATION	DATE / TIME OF SAMPLING	TSP (MG/NM^3)	PM_{10} (MG/NM^3)	SO_2 (MG/NM^3)	NO_2 (MG/NM^3)
AQ1-2021	Near Villa Imperial residences	November 14-15,2021/ 10:16 AM-10:16 AM	68.1	16.9	7.2	2.0
AQ2-2021	Sitio Maligaya	November 15-16,2021 / 10:23AM-10:23 AM	32.1	15.9	16.9	1.0
AQ3-2021	Near Barangay Alion	November 11-12,2021 / 9:00 AM-9:00 AM	24.9	23.6	1.7	8.6
AQ4-2021	Near Alion Barangay Hall	November 13-14,2021 /9:40 AM-9:40 AM	44.5	17.0	8.2	2.1
AQ5-2021	Near residential area in Barangay Mountain View	November 16-17,2021 / 10:30 AM-10:30 AM	41.0	12.4	22.8	7.1
AQ6-2021	Near Sitio Paliparan, Barangay Bataan II	November 12-13,2021 / 9:30 AM-9:30 AM	38.0	13.7	20.8	2.0
NAAQG			230	150	180	150

Table 2-71 Measured concentrations of $PM_{2.5}$, SO_2,, NO_2, PM_{10}, and Pb on February 7 to 11, 2023

STATION	LOCATION	DATE / TIME OF SAMPLING	$PM_{2.5}$ (MG/NM^3)	SO_2 (MG/NM^3)	NO_2 (MG/NM^3)	PM_{10} (MG/NM^3)	PB (MG/NM^3)
AQ1	Sitio Iningles Stalion	February 7-8, 2023/ 9:30 A.M.-9:30 A.M.	9.5	10.59	3.31	15.3	0.006
AQ2	Sitio Iningles Near Town Site	February 8- 9, 2023/ 9:40 A.M. – 9:40 A.M.	7.7	1.49	2.85	23.1	0.005
AQ3	Alion Crossing	February 9-10, 2023/ 10:00 A.M.–10:00 A.M.	6.0	10.21	2.84	9.7	0.015
AQ4	Alion Manggahan St.	February 10-11, 2023/ 10:10- A.M.-10:00 A.M	10.2	3.90	3.83	31.0	0.012
NAAQG			35	180	150	150	1.5 (3 months)

Table 2-72 Measured concentrations of As, Cd, Ni and Zn on February 7 to 11, 2023

STATION	LOCATION	DATE / TIME OF SAMPLING	ARSENIC (MG/NM^3)	CADMIUM (MG/NM^3)	NICKEL (MG/NM^3)	ZINC (MG/NM^3)
AQ1	Sitio Iningles Stalion	February 7-8, 2023/ 9:30 A.M.-9:30 A.M.	ND	ND	ND	0.07
AQ2	Sitio Iningles Near Town Site	February 8- 9, 2023/ 9:40 A.M. – 9:40 A.M.	ND	ND	ND	0.07
AQ3	Alion Crossing	February 9-10, 2023/ 10:00 A.M.–10:00 A.M.	ND	ND	ND	0.06
AQ4	Alion Manggahan St.	February 10-11, 2023/ 10:10- A.M.-10:00 A.M	ND	ND	0.0015	0.07

Notes: (1) NAAQS for As = 30 µg/Nm^3 and Cd = 10 µg/Nm^3; (2) NAAQS for Ni and Zn – not specified in DAO 2000-81

Table 2-73 Measured Concentrations of Air Pollutants for 24-Hour Monitoring (February 2023)

STATION	LOCATION	DATE / TIME OF SAMPLING	CO (MG/NM^3)	MERCURY (MG/NM^3)	COPPER (MG/NM^3)
AQ1	Sitio Iningles Stalion	February 7-8, 2023/ 9:30 A.M.-9:30 A.M.	<1.146	0.006	0.16
AQ2	Sitio Iningles Near Town Site	February 8- 9, 2023/ 9:40 A.M. – 9:40 A.M.	<1.146	0.003	0.13
AQ3	Alion Crossing	February 9-10, 2023/ 10:00 A.M.–10:00 A.M.	<1.146	0.002	0.14
AQ4	Alion Manggahan St.	February 10-11, 2023/ 10:10- A.M.-10:00 A.M	<1.146	0.006	0.26

Notes: (1) NAAQ for CO = 35 mg/Nm^3 (1-hour average)and 10 = mg/Nm^3 (8-hour average); (2) NAAQS for Hg and Cu – not specified

Table 2-74 Air quality indices in November 2021 and February 2023 sampling

POLLUTANT	RANGE (MG/M^3)	NOVEMBER 2021	FEBRUARY 2023
TSP	0 to 80	24.9 to 68.1 µg/Nm^3 - Good condition	*
PM_{10}	0 to 54	12.4 to 23.6 µg/Nm^3 - good condition	9.7 to 15.3 - good condition
$PM_{2.5}$	0 to 25	*	6 to 10.2 µg/Nm^3 - good condition
SO_2	0 to 0.034 ppm (0 to 89.1)	1.7 to 20.8 µg/Nm^3 – good condition	1.49 to 10.59 µg/Nm^3 - good condition
CO	0 to 4.4 ppm (8 hours) (0 to 5.04 mg/m^3)	*	< 1.156 mg/Nm^3 – good condition

** no data*

2.4.2.1.2 Impact Assessment and Mitigation Measures

Construction Period

During the project's construction, particulate and gaseous air pollutants are expected to be generated from the operation of heavy equipment, vehicles, and other construction equipment.

Particulate emissions will be generated during site preparation, construction of the poultry houses and related facilities, such as feed storage areas, manure stage areas, and other buildings, and during demobilization works. Site preparation will involve earthworks for the access road and foundation works of the buildings and facilities to be constructed and will include grading, scraping, bulldozing, materials handling, and transport of excavated materials and other construction materials. Fugitive emissions arising from the movement of vehicles along roads, and construction sites are also expected to generate dust emissions.

Further, tailpipe emissions (particulate and gaseous air pollutants) will be emitted during the operation of heavy equipment, such as wheel loaders, backhoes, dump trucks, and graders, including generator sets, if these will be utilized during construction. Sulfur oxides, nitrogen oxides, and carbon monoxide are the primary gaseous air pollutants emitted from heavy equipment, vehicles, generator sets, or, in general, any equipment with an internal combustion engine.

The rules and regulations related to prohibition of emissions of particulate matter is stipulated in Section 13 (Prohibited Acts) of the implementing rules and regulations of the Philippine Clean Air Act (PCAA) of 1999 (or DAO 2000-81), which stipulates that "no person shall cause, let, permit, suffer or allow the emission of particulate matter from any source whatsoever, including, but not limited to, vehicular movement, transportation of materials, construction, alternation, demolition or wrecking or industry related activities such as loading, storing or "handling," without taking reasonable precautions to prevent such emission".

The above-mentioned rule on fugitive emissions also presents mitigation measures as follows:

1. Use, where possible, of water or chemicals for control of dust from construction and quarrying or clearing of lands;
2. Application of water or suitable chemicals on roads, materials of stockpiles, and other surfaces which create airborne dust problems; and
3. Installation and use of hood fans and fabric filters or any other suitable control devices to enclose and vent the handling of dusty materials. Adequate containment methods shall be employed during sandblasting or other similar operations.

The other recommended mitigation measures to control or reduce fugitive particulate emissions are as follows:

1. Setting up wheel washing facilities at the construction site, particularly during rainy or wet seasons. This is an effective method to remove mud from the tires of heavy equipment and other vehicles going out of the project site, which will be sources of particulate emissions outside the facility (e.g., paved or unpaved roads) when dried up,
2. Impose speed limits within the construction site and along access roads,
3. Limit construction works during arid and windy conditions, mainly when dust is visibly dispersed outside the project site,
4. Use wind erosion measures (e.g., windbreakers) and cover storage piles, if necessary,
5. Prevent possible spillage of materials along roads by providing the appropriate cover of haul materials in the truck,
6. Limit the idling of vehicles as much as possible to minimize the release of air pollutants. The recommended idling time is no more than three minutes while parking or stopping, though engines may idle when necessary, such as cement mixers and content delivery equipment (Source: www.doee.dc.gov),
7. Develop and implement an effective traffic management plan for continuous traffic flow, thereby reducing fuel consumption and tailpipe emissions, and
8. Maintenance of the heavy equipment, vehicles, and other construction equipment following the manufacturer's specifications and legal requirements

Operations Period

The operation of the project will generate air emissions and odor emanating from handling manure, feeds, ventilation systems in poultry houses, and equipment operation during cleaning, feeding, and waste management. When mitigation measures to control odor are not adequately implemented, the proposed project will disperse foul odors over wide distances depending on wind direction, atmospheric stability, and topography.

Expected sources of odor during project operation include, among others, overloaded manure in poultry bedding, spoiled feeds, uncovered manure piles, improper disposal of dead animals, exhaust air ventilation, dust from feeders and animals, and wet manure below-caged layer (Chastain, J. 2001).

Furthermore, infestation of flies in the poultry farm and nearby areas are common problems for this type of project if not adequately mitigated or controlled. Poultry farm manures and other decayed or organic materials are desirable mediums for the development of the fly population.

In the Province of Bataan, the Sangguniang Panlalawigan issued Ordinance No. 8, Series of 2019, which regulates the operation of piggeries, poultry farms, and other livestock-raising entities in the province. The standards and requirements in the above-mentioned local ordinance related to odor and air emissions in poultry farms are provided below (Reference: Article IX – Standards and Requirements of Ordinance No. 8, Series of 2019, of the Sangguniang Panlalawigan of the Province of Bataan).

a) The location is preferably in areas of high topography and broad terrain for sufficient ventilation,
b) Preferably on well-drained and porous soil types and should not be on moisture-retentive soil or those with high moisture levels,
c) Surround with buffer zones which should be planted with trees or shrubs,
d) At least one (1) kilometer away from other poultry farm or piggery to minimize the spread of pests and to reduce pollutant concentration in a particular area. It shall also be at least 500 meters from the national highways and major roads and at least 1 kilometer away from built-up areas (residential, commercial, institutional, and industrial), as designated in the particular Municipality's Comprehensive Land Use Plan),
e) The position of the building shall be oriented towards the direction of the wind and/or sunlight and in an east-west direction. The long axis of the building shall be laid in a north-south direction to give all pens the benefit of the sun,
f) Encourage maintaining a generator set sufficient to supply power to avoid problems in water supply, ventilation and cooling, heating and moisturizing need of the livestock, and waste disposal,
g) Mandatory use of chemicals to control flies and their larvae,
h) Endeavor to use feeds and supplements that minimize foul odor in the discharges and wastes, and
i) Strictly follow the prescribed ratios of heads to the area of the facility, which shall be based on applicable generally accepted industry standards.

The above standards and requirements, as stipulated in the ordinance of the Province of Bataan, also serve as efficient design and mitigation controls to lessen or eliminate air and odor emissions.

Furthermore, the following are other recommended measures to lessen or eliminate, as possible, nuisance odor from the project.

1) Provision of adequate bedding for each block of birds,
2) Regular removal and proper disposal of manure from buildings,
3) Use of mechanical ventilation to ensure adequate supply of fresh air, remove excess moisture, provide sufficient temperature, and limit temperature rise during hot weather conditions,
4) Regular cleaning of the interior of the building surfaces,
5) Control and monitoring of relative humidity and air temperature inside poultry houses,
6) Incorporate manure into the soil as soon as possible, preferably during intense insolation, and
7) Regulator maintenance of ventilation fans and other equipment

2.4.2.2 Noise Quality

Noise impact assessment involved monitoring background noise levels outside the project site and at the nearest noise-sensitive receptors and the qualitative assessment of the project's anticipated impact during construction and operation.

2.4.2.2.1 Methodology

Ambient Noise Standards and Nuisance

The then National Pollution Control Commission (NPCC) (now DENR) in 1978 and established the ambient noise standards in the Philippines. **Table 2-75** shows the ambient noise standards and is categorized into four (4) time periods within the 24-hour period. The applicable noise standards for daytime, morning/evening, and nighttime for residential areas are 55, 50, and 45 dBA, respectively.

Table 2-75 Environmental Quality Standards for Noise in General Areas (NPCC MC 1980-002)

Category of Area	Maximum Allowable Noise (dBA) by time periods		
	Daytime (9:00 A.M. to 6:00 P.M)	Morning/Evening (5:00 A.M. to 9:00 AM/ 6:00 P.M. to 10:00 P.M.	Nighttime (10:00 P.M. to 5:00 A.M).
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

- Class AA- a section of contiguous area which requires quietness, such as areas within 100 meters from school site, nursery schools, hospitals and special house for the aged
- Class A - a section of contiguous area which is primarily used for residential area
- Class B - a section of contiguous area which is primarily a commercial area
- Class C - a section of contiguous area reserved as light industrial area
- Class D-a section which is primarily reserved as heavy industrial area

Article 694 of Republic Act No. 386 (Civil Code of the Philippines) defined nuisance as "…"any act, omission, establishment, business, condition of property, or anything else which;

1) Injures or endangers the health or safety of others; or
2) Annoys or offends the senses; or
3) Shocks, defies or disregards decency or morality; or
4) Obstructs or interferes with the free passage of any public highway or street, or any body of water; or
5) Hinders or impairs the use of property.

Furthermore, Article 695 of the RA No. 386 provides that nuisance is "either public or private. A public nuisance affects a community or neighborhood or any considerable number of persons, although the extent of the annoyance, danger or damage upon individuals may be unequal. A private nuisance is one that is not included in the foregoing definition".

Thus, excessive noise levels or odor are examples of nuisance, as these injure or endanger the health or safety of others and annoy or offend the senses.

Background Noise Monitoring

a) Monitoring Site Location

There were four (4) monitoring stations established for background ambient noise monitoring on February 7 to 11, 2023 (**Table 2-76** and **Figure 2-68**). The locations of noise sampling stations are generally at or near the air stations.

Table 2-76 Locations and coordinates of noise sampling stations

Station ID	Location	Geographical Coordinates
N1	Sitio Iningles Stalion	14°28'47.90"N 120°33'56.55"E
N2	Sitio Iningles Near Town Site	14°28'31.47"N 120°34'4.75"E
N3	Alion Crossing	14°29'23.68"N 120°34'17.00"E
N4	Alion Manggahan St.	14°29'19.56"N 120°34'47.78"E

Note: Coordinates of air sampling stations

Noise monitoring was conducted with the four (4) periods specified in the NPCC (1978) and NPCC (1980). The time periods are daytime (09:00 A.M. to 6:00 P.M.), evening (6:00 P.M. to 10:00 P.M.), nighttime (10:00 P.M. to 5:00 A.M.), and morning (5:00 A.M. to 09:00 A.M)

b) Monitoring Method

Ambient noise monitoring was performed in accordance with NPCC (1978), which sets the median of seven maximum readings. As there is no specific local methodology on how to conduct noise measurement, the sampling procedure provided by Wilson (1989) was adopted in the monitoring.

Wilson (1989) requires the recording of instantaneous noise levels that appear in the monitor display every ten (10) seconds until a total of fifty (50) readings are recorded. The median of the seven maximum noise levels then gives the noise level comparable to the ambient noise standard.

c) Sound Level Meter (SLM)

The SLM used was a Lutron Peak Meter. It was set at A mode and slow response, as required in NPCC (1978)

Plate 2-35 shows the geotagged photographs during noise monitoring at Stations N1 to N4.

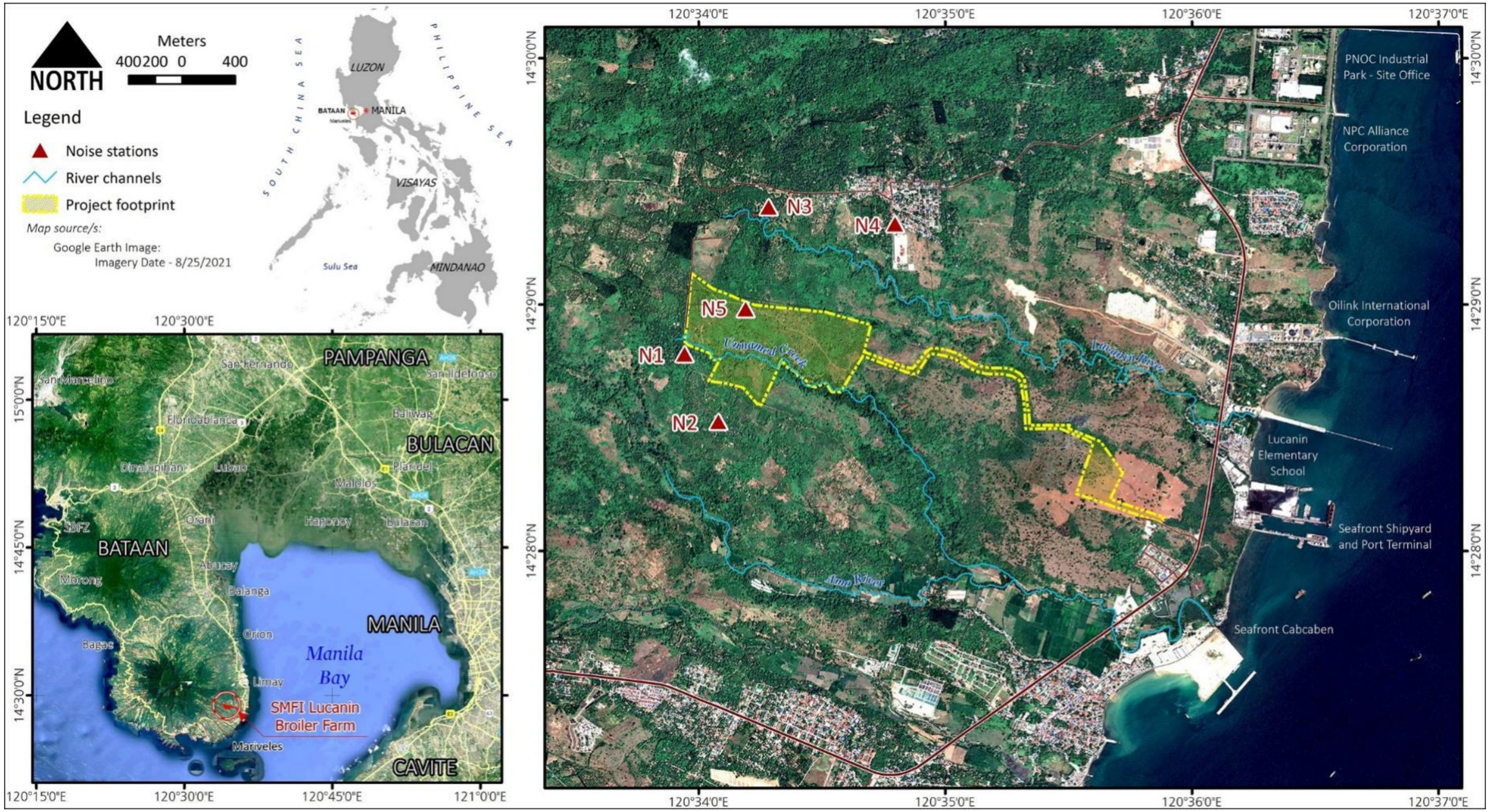


Figure 2- 68 Locations of noise sampling stations

N1

N2

N3

N4

Plate 2- 35 Measurement of sound levels at Stations N1 to N4 using a Peak Meter Sound Level Meter (SLM) on February 7-11, 2023

d) Statistical Noise Levels

Analysis of noise data included the determination of equivalent sound level (L_{eq}), sound levels exceeded 10% of the time (L_{10}), and sound levels exceeded 90% of the time (L_{90}). L_{eq} was calculated using the following formula:

$$L_{eq} = 10\log_{10}\left[\frac{1}{N}\sum_{i=1}^{n} 10^{\frac{Li}{10}}\right]$$

where,

L_{eq} = equivalent noise level,

L_i = instantaneous noise level, and

N = total number of noise data

L_{10} and L_{90} refers to the peaks of noise levels and background noise levels, respectively, which were computed using the functions in EXCEL worksheet.

The median of the seven highest noise readings is the 4th highest noise level from the 50 noise levels.

Background Noise Levels

Figure 2-68 shows the plots of the measured noise levels at Stations N1 to N4 in four (4) time periods on February 7-11, 2023. These plots are instantaneous noise levels that appeared on the display screen every ten (10) minutes for a total of 50 readings.

Noise levels in **Figure 2-69** are segregated into four (4) time periods, namely: morning, daytime, evening, and nighttime, as shown in **Figure 2-70** to **Figure 2-73**, respectively, to check variations with the respective ambient noise standards. Results show that 1 to 3 readings are greater than the respective noise standards for morning, daytime, and evening noise standards, and in the nighttime, there appear noise readings greater than 45 dBA (ambient noise standard). Note that plots in **Figure 2-70** to **Figure 2-73** only show variations of noise levels with the ambient noise standard, but these are not comparable with the ambient noise standards as the median of the seven high noise readings should be determined, which are then compared with the ambient noise standard.

Table 2-77 and **Figure 2-74** show that the median of the seven highest noise readings at Stations N1 to N4 were all within the respective ambient noise standards. These show relatively tranquil conditions typical of rural areas, the sources of noise of which were mostly from animals and insects, people conversing, and on some occasions, passing motorcycles (**Table 2-77**).

The L_{90} levels or sometimes referred to as background noise levels were way lower than the median levels- about a 2 to 5 dBA difference. This suggests low background noise in the absence of the occasional noise sources in the area.

Table 2-77 Median noise levels and applicable ambient noise standards at the noise sampling stations

STATION ID/PERIOD	MEDIAN (DBA)*	AMBIENT NOISE STANDARD - RESIDENTIAL AREA (DBA)
N1 (Morning)	47.4	50
N1 (Daytime)	43.3	55
N1 (Evening)	48.9	50
N1 (Nighttime)	44.3	45
N2 (Morning)	48.7	50
N2 (Daytime)	50	55
N2 (Evening)	49.4	50
N2 (Nighttime)	44.7	45
N3 (Morning)	44.3	50
N3 (Daytime)	43.1	55
N3 (Evening)	48.3	50
N3 (Nighttime)	42.4	45
N4 (Morning)	40.9	50
N4 (Daytime)	49.8	55
N4 (Evening)	48.1	50
N4 (Nighttime)	44.5	45

*Median of 7 highest noise readings

Table 2-78 Sources of noise at the time of monitoring on February 7 to 11, 2023

STATION	LOCATION	SOURCES OF NOISE
N1	Sitio Iningles Stalion	Bird chirping, people conversing, passing vehicle at daytime, and rustling wind at night time.
N2	Sitio Iningles Near Town Site	People conversing, dog barks at daytime and morning, and insect at night time.
N3	Alion Crossing	People conversing, dog barks at daytime and passing motorcycle at night time.
N4	Alion Manggahan st.	People conversing, passing of motorcycle and dog barks in all time periods

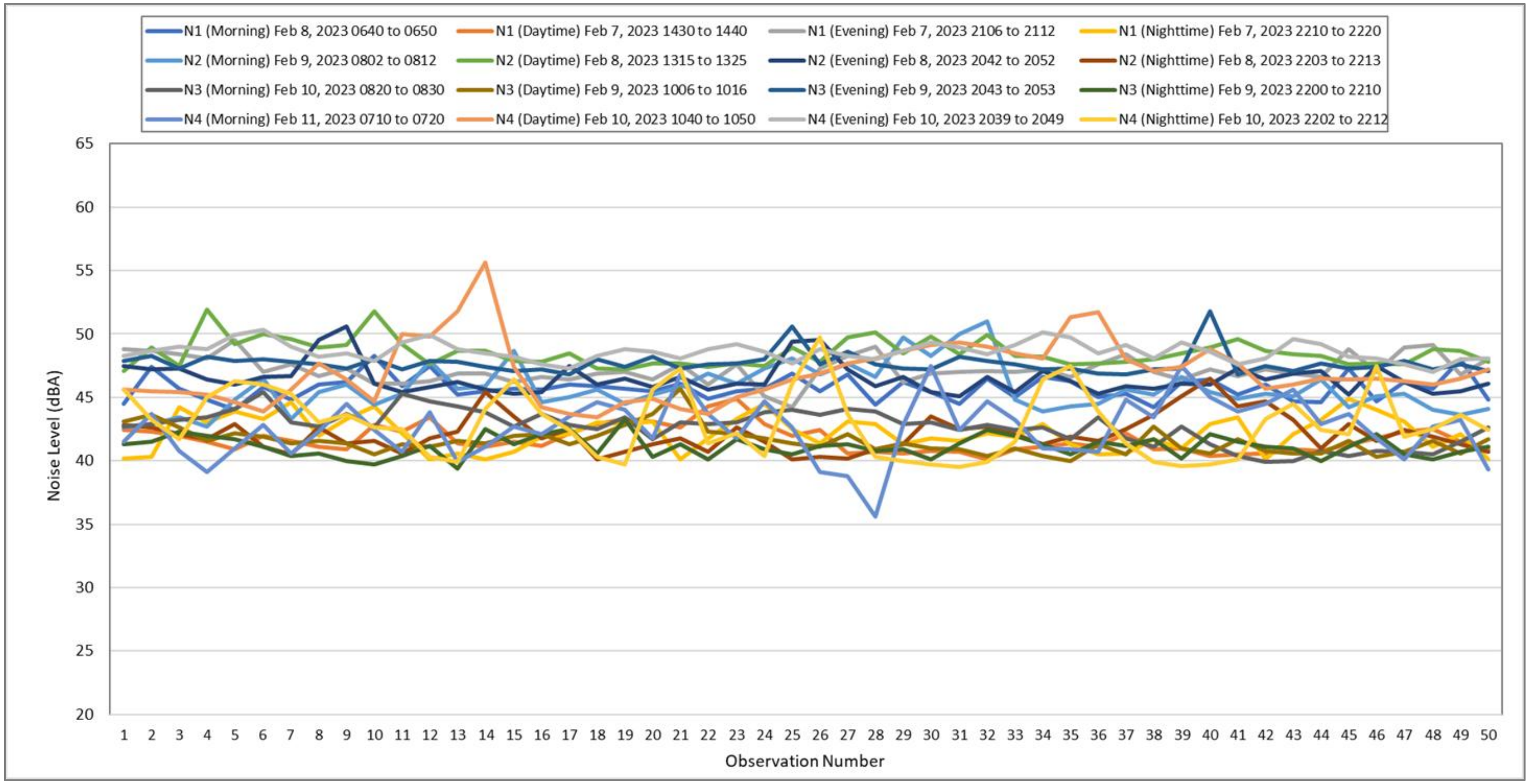


Figure 2- 69 Noise levels at Stations N1 to N4 at four (4) time periods (morning, daytime, evening, and nighttime)

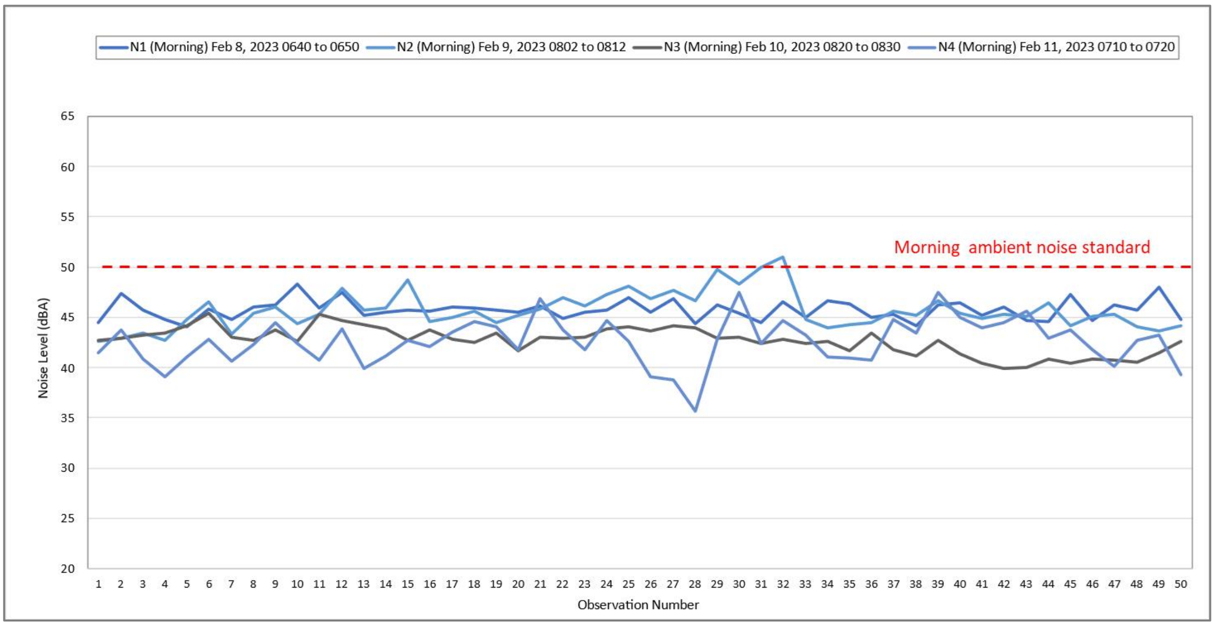


Figure 2- 70 Noise levels measured in the morning at Stations N1 to N4

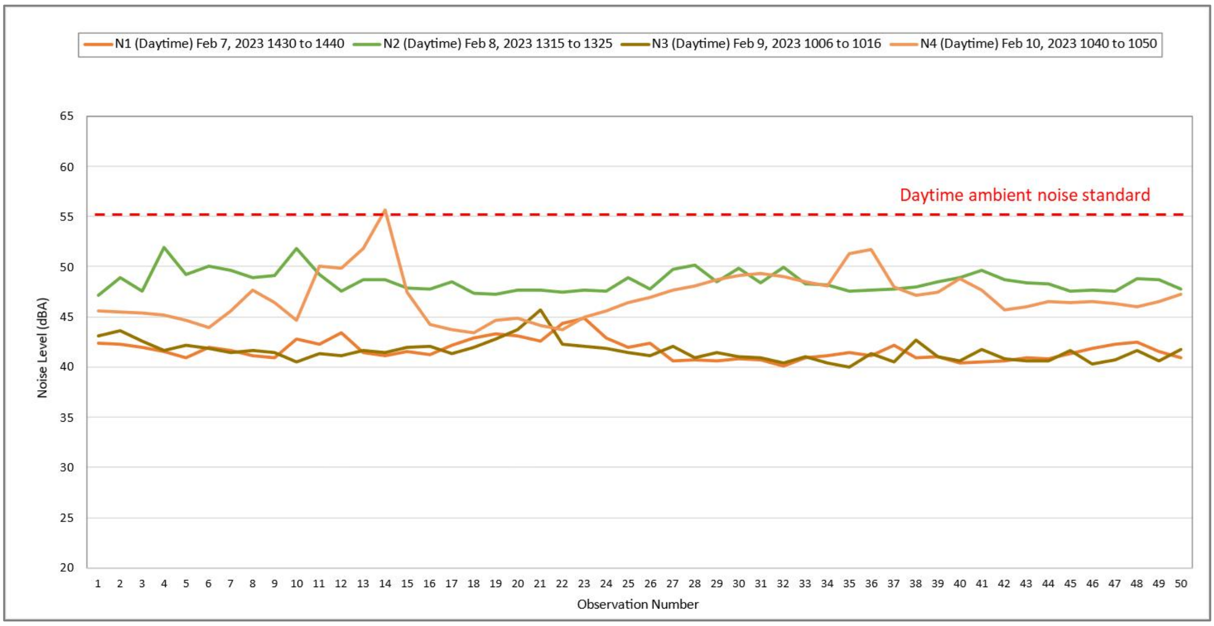


Figure 2- 71 Noise levels measured in daytime at Stations N1 to N4

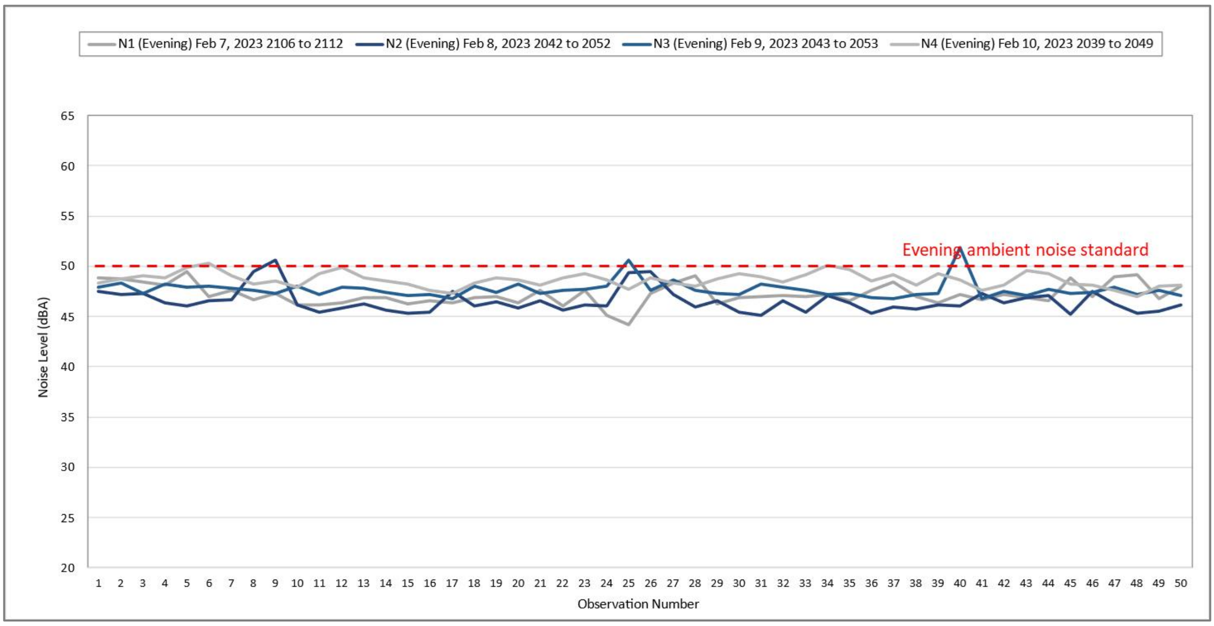


Figure 2- 72 Noise levels measured in the evening at Stations N1 to N4

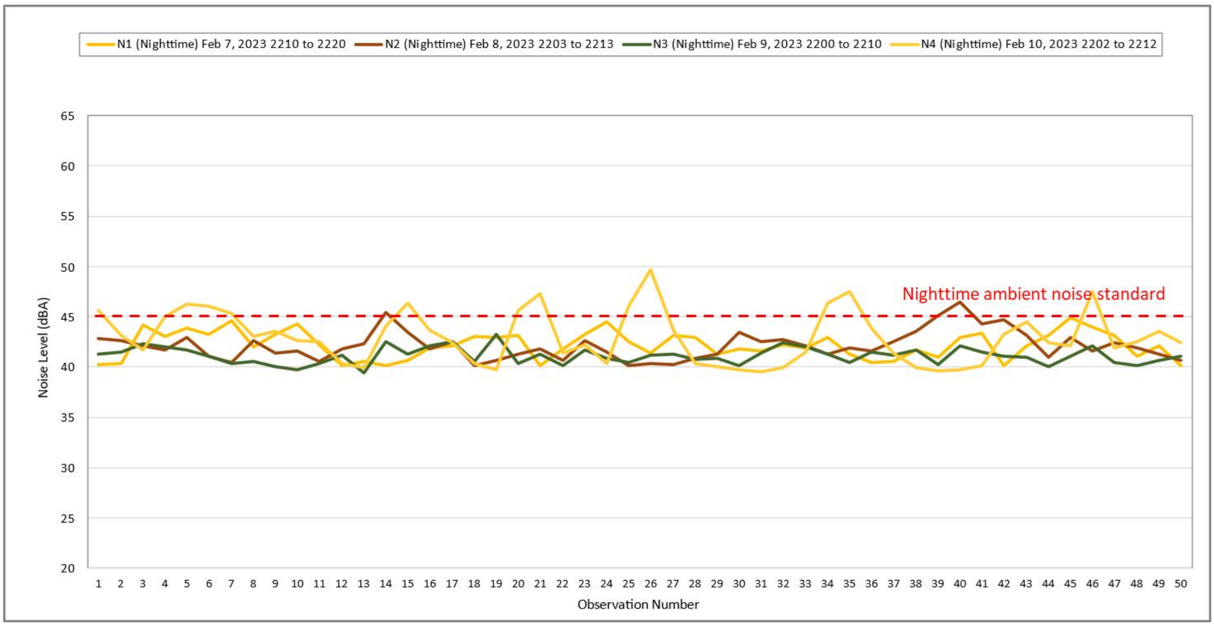


Figure 2- 73 Noise levels measured at nighttime at Stations N1 to N4

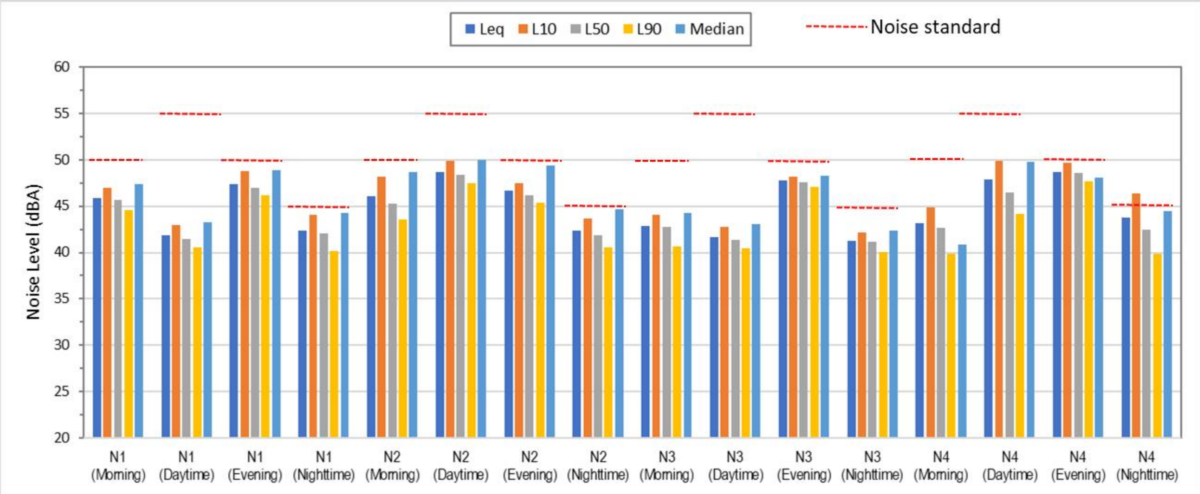


Figure 2-74 Plot of statistical noise levels and ambient noise standard

2.4.2.2.2 Impact Assessment and Mitigation Measures

The potential noise sources during construction are the operation of heavy equipment and other construction equipment. **Table 2-79** shows that noise levels as high as 85 dBA are attenuated about 15 m from heavy equipment or vehicles. The impact of the attenuated noise levels on the nearby NSRs could be moderate to significant, depending on the distances between the NSRs and the noise sources.

Table 2-79
Noise levels at 15 m from selected equipment and corresponding usage factor

HEAVY EQUIPMENT/VEHICLE	SOUND LEVEL AT 50 FT (DBA)	USAGE FACTOR (%)
Pickup truck	55	40
Backhoe	80	40
Excavator	85	40
Earth transport vehicle (dump truck)	84	40
Grader	85	40
Diesel generator unit	82	40
Concrete mixer truck	85	40

Source: U.S. FHWA Final Report, 2006

As the background noise levels in the area are relatively low, the operation of heavy equipment, vehicles, and other construction equipment during the construction period could cause a nuisance to nearby residents. The following are the mitigation measures to control or lessen noise emissions during project construction.

1) Installation of adequate or appropriate mufflers at tailpipes of mobile equipment and generator sets
2) Reduction on the number of operating equipment, particularly during nighttime and early morning/evening periods, if construction during nighttime will result in excessive noise at nearby noise-sensitive receptors;
3) Strictly impose speed limits on access roads and within the project area.
4) Provision partial or total enclosure of high noise sources, when necessary

During the project's operation, noise emissions from the project may be insignificant compared to the possible nuisance caused by odor emissions. In any case, noise monitoring shall be regularly conducted to check compliance with ambient noise standards, and to implement mitigating measures, when necessary.

3 IMPACT MANAGEMENT PLAN (IMP)

Water pollution, liquification and settlement, air pollution and solid waste generation are the most significant impacts identified for the project. The mitigating measures are presented in **Table 3-1**.

3.1 IMPACT MANAGEMENT PLAN (IMP)

The proponent proposes to continuously implement and monitor their environmental performance through Impact Management Plan (IMP).

Table 3-1 Impact Management Plan for Lucanin Multi-Tier Broiler Project

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
I. Pre-Construction Phase						
	The Land					
Clearing of vegetation for initial access roads and facilities	Terrestrial flora	Decrease in flora cover; Loss of vegetation; Biodiversity decline	• Design the location of roads and facilities where none to minimal tree individuals will be cleared. As much as possible, avoid areas with premium, endemic and endangered species.. • Limit clearing to the proposed footprint of facilities to avoid unnecessary vegetation and habitat removal • Designate buffer zones or 'no-take' zones within the project site.	Proponent and outsourced Terrestrial Flora expert)	Php 100,000	Included in the EMoP, ECC condition
	Terrestrial fauna	Possible displacement of existing wildlife animals	• Areas to be cleared should be delineated by fences to avoid excessive removal of vegetations. Areas to be cleared of vegetation should be rehabilitated to near pre-project conditions as possible. This would entail reforestation using indigenous plant species.	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
	Land Geology, geomorphology, Geohazards	Erosion, slope failure, inducement of landslides, seismic activity, liquefaction	• Conduct necessary activities in the planning and design including slope stability and foundation studies, as well as seismic studies including site-specific peak ground acceleration (PGA) potential. • Account for the possible effects of climate change in the change in the amount of rainfall and number of days with rain.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
Generation of noise	Terrestrial fauna	Displacement of animals due to noise Affect navigation capability of birds and bats species	• Operation of high noise-emitting equipment and vehicles must be scheduled to prevent unnecessary activities. • Equipment and vehicles must be subjected to regular maintenance to minimize excessive noise	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
II. Construction Phase						
Land clearing and excavation	**The Water**					
	Plankton community	Siltation/sedimentation and turbidity which would tend to limit light penetration in the water column which is essential in phytoplankton photosynthesis; would also slightly increase mortality of fish eggs/larvae (ichthyoplankton) including other planktonic organisms. However, these impacts are insignificant and temporary	• Provision of temporary drainage canals with silt traps or basin to intercept washed out soil particles particularly in areas of excavation. • Surface run-off should be directed into a temporary ditch to allow settlement of suspended solid • Mound of soils and construction spoils should not be placed near the creek/river to avoid its movement towards the bay waters. • Filling materials should be immediately transported to the fill area and compacted to avoid its transport to the bay through runoff. • Regular disposal of construction spoil should be done to prevent accumulation in the site which could increase the possibility of its transport to the sea	Proponent's Environmental Unit/Contractor	Part of construction cost	Proponent and Contractor's MOA
Project construction activity	Soft bottom benthos	No seabed disturbance since there will be no project construction activities along the shoreline which is about 2.25 km from the poultry farm project . Therefore, there will be no any significant effect on the soft bottom benthic communities in the area	• No mitigation is needed	-	-	-
	Coral, seagrass and mangrove communities	None of these sensitive biological communities (SBCs) were found to occur in the area. Therefore, no negative impacts are predicted	• No mitigation is needed	-	-	-

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
	Local fisheries	Significant impacts to fisheries resources are unlikely due to the distant location of their traditional and municipal fishing grounds/operations from the proposed broiler farm project	• No need for mitigation of impacts is required	-	-	-
	Surface water quality	Decreased water quality due to erosion and sedimentation	• Sediment Control: To prevent sediment from entering nearby water bodies, sediment control measures such as silt fences, sediment basins, and vegetation cover can be used. Implementing soil conservation practices, such as cover cropping and conservation tillage, to reduce the potential for sediment runoff. • Properly managing construction waste: Construction waste such as excess soil, concrete, and chemicals can potentially contaminate water. To prevent contamination, construction waste should be properly managed and disposed of in accordance with local regulations. • Conducting water quality monitoring: Prior to construction, water quality monitoring can be conducted to establish baseline conditions and identify any potential sources of pollution. Regular monitoring during and after construction can also help to identify and address any issues that may arise. • Implementing Best Management Practices (BMPs): BMPs can be used to manage and minimize the impact of construction activities on water quality. These may include techniques such as slope stabilization, revegetation, and stormwater management practices.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	PPart of DED / Construction Cost and Also Included in the EMoP, ECC condition
		Degradation from sewage, wastewater and solid waste	• Proper waste management: Implement proper waste management practices during construction, including proper disposal of sewage and solid waste. Ensure that waste is properly stored, collected, and disposed of in accordance with local regulations. • Install proper wastewater facilities: Install proper wastewater treatment facilities to ensure that any wastewater generated during construction is disposed of properly. • Implement erosion and sediment control measures: Implement erosion and sediment control measures to prevent soil erosion and sedimentation, which can lead to increased nutrient and bacteria levels in water bodies. • Establish buffer zones: Establish buffer zones around water bodies to prevent any potential negative impacts on water quality. • Monitor construction activities: Monitor construction activities to ensure that there are no leaks or spills of hazardous materials that could potentially contaminate water sources. • Conduct regular water quality testing: Conduct regular water quality testing to monitor for any changes in water quality, and take appropriate action if any issues are identified. • Engage with local communities: Engage with local communities and stakeholders to identify any concerns or issues related to water quality and take these into consideration in the planning process.	Proponent / Contractor	Include in TOR of Detailed Engineering Design	Part of DED / Construction Cost and Also Included in the EMoP, ECC condition
	Streamflow	Disruption of water flow	• Avoiding stream channelization: Stream channelization, or the straightening and deepening of streams, can cause changes in water flow patterns and disrupt natural habitats. To prevent this, it is important to avoid stream channelization and preserve the natural flow of streams and waterways. • Implementing erosion control measures: Construction activities can cause soil erosion, leading to sedimentation and the disruption of water flow. To prevent this, erosion control measures such as silt fences, sediment basins, and vegetation cover can be used to trap sediment and prevent it from entering nearby waterways.	Proponent / Contractor	Include in TOR of Detailed Engineering Design	Part of DED / Construction Cost

Project Phase / Environmental Aspect (Project Activity which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement	Responsible Entity	Cost	Guarantee / Financial Arrangements
			• Minimizing land disturbance: Minimizing land disturbance during construction can help to prevent soil erosion and minimize the potential for sediment runoff. This can be achieved by using proper excavation techniques, avoiding unnecessary grading, and limiting the use of heavy equipment. • Using BMPs for stormwater management: Best Management Practices (BMPs) can be used to manage stormwater runoff and prevent disruption of water flow. Techniques such as vegetated swales, infiltration trenches, and permeable pavements can help to slow down and filter stormwater runoff, promoting infiltration and reducing erosion. • Conducting hydrological studies: Prior to construction, hydrological studies can be conducted to evaluate the site's drainage patterns and identify any potential impacts on water flow. This can help to inform the design of stormwater management measures and ensure that water flow is maintained throughout construction.			
Transportation of materials, machineries and equipment to project site Operation and maintenance of vehicles and heavy equipment	Surface and groundwater Quality	Decreased water quality due to erosion and sedimentation	• Sediment Control: To prevent sediment from entering nearby water bodies, sediment control measures such as silt fences, sediment basins, and vegetation cover can be used. Implementing soil conservation practices, such as cover cropping and conservation tillage, to reduce the potential for sediment runoff. • Properly managing construction waste: Construction waste such as excess soil, concrete, and chemicals can potentially contaminate water. To prevent contamination, construction waste should be properly managed and disposed of in accordance with local regulations. • Conducting water quality monitoring: Prior to construction, water quality monitoring can be conducted to establish baseline conditions and identify any potential sources of pollution. Regular monitoring during and after construction can also help to identify and address any issues that may arise. • Implementing Best Management Practices (BMPs): BMPs can be used to manage and minimize the impact of construction activities on water quality. These may include techniques such as slope stabilization, revegetation, and stormwater management practices.	Proponent / Contractor	Include in TOR of Detailed Engineering Design	Part of DED / Construction Cost and Also Included in the EMoP, ECC condition
Clearing of vegetation and earth moving activities; change in land use	**The Land**					
	Terrestrial flora	• Loss of vegetation; • Loss of ethnobotanically important species; • Biodiversity decline	• Off-setting of lost vegetation through rehabilitation of suitable planting areas with native vegetation species; • Earth-balling of affected premium and endangered forest tree species (if applicable); • Regular monitoring of species composition in the baseline sites	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)	Php 75,000/monitoring period	Included in the EMoP, ECC condition
	Terrestrial fauna	• Possible displacement of existing wildlife animals	• Areas to be cleared should be delineated by fences to avoid excessive removal of vegetations. Areas to be cleared of vegetation should be rehabilitated to near pre-project conditions as possible. This would entail reforestation using indigenous plant species.	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Generation of noise	Terrestrial fauna	• Displacement of animals due to noise • Affect navigation capability of birds and bats species	• Operation of high noise-emitting equipment and vehicles must be scheduled to prevent unnecessary activities. • Equipment and vehicles must be subjected to regular maintenance to minimize excessive noise	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
Excavation of soil	Terrestrial Fauna	• Dust emission may result to respiratory impairment of wildlife animals	• For large vehicles that expire dust and smoke, devise a routing scheme for hauling vehicles to minimize areas to be disturbed and water should be sprinkled to minimize dust accumulation and spreading	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Disposal of waste materials such as oil from large equipment and vehicles, and garbage from personnel workers	Terrestrial Fauna	• Waste materials can be ingested by wildlife animals • Wildlife animals can be entangled by the waste materials • Released chemicals from the vehicles can be harmful to wildlife animals	• Proper waste management plan by the project proponent • Equipment and vehicles must be checked regularly to avoid generation of oil waste materials • Waste disposal should be coordinated with the project management to avoid excessive accumulation of wastes.	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Clearing, grubbing, excavation, and ground preparation Transportation of materials, machineries and equipment to project site Operation and maintenance of vehicles and heavy equipment	Land use and classification	• Change in land use and tenure	• Verify land-use assessment: Before construction begins, conduct a verification of the land-use assessment to identify the current land use and tenure status of the proposed construction site. This assessment should include consultation with local authorities and communities. • Respect existing land tenure: Respect the existing land tenure by ensuring that landowners are fairly compensated for any land use changes, and by securing the necessary permits and approvals from local authorities. • Engage with local communities: Engage with local communities and stakeholders to identify any concerns or issues related to land use and tenure status, and take these into consideration in the planning process. • Establish buffer zones: Establish buffer zones around the construction site to prevent any potential negative impacts on neighboring land uses. • Monitor construction activities: Monitor construction activities to ensure that land use and tenure status is not negatively impacted by the construction of the broiler farm.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
		• Encroachment and disturbance of ECAs	• Conduct a site assessment: Before construction begins, conduct a site assessment to identify any protected areas near the proposed construction site. This assessment should include a review of local and national laws and regulations related to protected areas. • Plan the construction carefully: Use the information from the site assessment to plan the construction activities carefully. Avoid any activities that could encroach on protected areas or cause unnecessary disturbance. • Work with local authorities: Consult with local authorities, including the Department of Environment and Natural Resources (DENR) and other relevant agencies, to ensure that all regulations and requirements related to protected areas are followed. • Establish buffer zones: Establish buffer zones around protected areas to prevent construction activities from encroaching on these areas. These buffer zones should be clearly marked and enforced throughout the construction process. • Implement environmental management practices: Implement environmental management practices during construction, such as proper waste management, erosion control measures, and sedimentation control measures. These practices can help prevent contamination and minimize the impact of construction activities on protected areas. • Monitor construction activities: Monitor construction activities to ensure that protected areas are not being encroached upon and that environmental management practices are being followed.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction
	Geohazards	• Inducement of effects of seismic activity	• Conduct a geohazard assessment: A geohazard assessment should be conducted to identify any potential geohazards in the construction site. The assessment should include an evaluation of the geology, soil conditions,	Proponent/Contractor	Include in TOR of Detailed Engineering	Part of DED / Construction Cost

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
			topography, and other factors that can contribute to geohazards such as landslides and soil liquefaction. • Implement engineering controls: Engineering controls such as retaining walls, slope stabilization measures, and ground reinforcement techniques can be implemented to prevent landslides and other slope failures. Soil nailing, anchoring, and geotextiles are some examples of ground reinforcement techniques that can be used. • Avoid areas prone to flooding: Construction activities can cause sedimentation and erosion, which can affect the natural flow of water and increase the risk of flooding. To mitigate this, it is important to avoid areas prone to flooding and ensure that proper stormwater management measures are in place. • Implement proper site drainage: Proper site drainage is critical in preventing soil erosion and surface runoff. Drainage systems such as swales and sediment basins can be used to capture sediment and filter runoff. • Monitor construction activities: Monitoring construction activities is essential to ensure that proper mitigation measures are being implemented and that geohazards are being managed effectively.		Design (DED) for Construction	
	Soil	• Loss of topsoil	• Whenever possible, convert topsoil and suitable dredge spoils for backfilling and landscaping within the project area.	Project proponent/ contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
		• Soil Erosion	• Implementing erosion control measures: Erosion control measures such as silt fences, sediment basins, and vegetation cover can be used to prevent soil erosion and protect nearby water resources.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost
		• Soil Contamination	• Properly storing construction materials: Construction materials such as concrete, lumber, and soil can potentially contaminate soil. To prevent contamination, these materials should be stored properly and away from sensitive areas. • Minimizing land disturbance: Minimizing land disturbance during construction can help to preserve soil structure and minimize the potential for soil contamination. This can be achieved by using proper excavation techniques, avoiding unnecessary grading, and limiting the use of heavy equipment. • Properly managing construction waste: Construction waste such as excess soil, concrete, and lumber can potentially contaminate soil. To prevent contamination, construction waste should be properly managed and disposed of in accordance with local regulations. • Conducting soil testing and monitoring: Regular monitoring during and after construction can also help to identify and address any issues that may arise.	Proponent / Contractor	Include in TOR of Detailed Engineering Design (DED) for Construction	Part of DED / Construction Cost and Included in the EMoP, ECC condition
	The Air					
Construction of project facilities and access roads	Air	• Increase in fugitive/ dust and gaseous emission	• Use, where possible, of water for control of dust from construction and quarrying or clearing of lands; • Setting up wheel washing facilities at the construction site, particularly during rainy or wet seasons. • Impose speed limits within the construction site and along access roads • Limit construction works during arid and windy conditions, mainly when dust is	Project proponent/ contractor	PhP 50,000 per month	Part of construction cost

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
			visibly dispersed outside the project site, • Use wind erosion measures (e.g., windbreakers) and cover storage piles, if necessary, • Prevent possible spillage of materials along roads by providing the appropriate cover of haul materials in the truck, • Limit the idling of vehicles as much as possible to minimize the release of air pollutants. The recommended idling time is no more than three minutes while parking or stopping, though engines may idle when necessary, such as cement mixers and content delivery equipment (Source: www.doee.dc.gov), • Develop and implement an effective traffic management plan for continuous traffic flow, thereby reducing fuel consumption and tailpipe emissions, and • Maintenance of the heavy equipment, vehicles, and other construction equipment following the manufacturer's specifications and legal requirements • Regulator maintenance of ventilation fans and other equipment			
Construction of project facilities and access roads	Noise	• Increase in noise levels	• Include Noise Mitigation Plan in the contractor's contract. Include compliance certificate. • Limit use of heavy equipment at nighttime, especially equipment that emits high noise level • Enclose high noise emitting equipment with temporary barriers and sound absorbing materials, when necessary. • Install adequate or appropriate mufflers at tailpipes of mobile equipment and generator sets • Reduce the number of operating equipment, particularly during nighttime and early morning/evening periods, if construction during nighttime will result in excessive noise at nearby noise-sensitive receptors; • Strictly impose speed limits on access roads and within the project area. • Provision partial or total enclosure of high noise sources, when necessary	Project proponent/ contractor	PhP 50,000 per month	Part of construction cost
	The People					
Construction of project facilities and access roads	Health and Safety	Risk on health and safety of the workers as well as the neighboring community	• Develop and implement a Construction Health and Safety Program • Establish and implement a solid waste management program • Close coordination with Barangay Local Government Units for any complaints (Complaints registry) • Residual wastes and hazardous wastes will be collected and transported to AFAB accredited landfill and/or treatment facilities by licensed waste transporters • Implementation of safe work methods and practices • Compliance to National Standards, local regulations and laws	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA
	Quality of Life: Health Services,Water Availability, and Sanitation	Disruption and/or competition indelivery of basic services and goods	• Provide housing and utilities for workers. • Ensure that contractor practice sustainable use of water. • Provide an Occupational Safety & Health Program for all employess and contractors • Close coordination with community leaders in promoting peace and order and acceptable lifestyle.	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA
	Quality of Life: Livelihood Opportunities	Generation of local employment. Increase in income for local residents and the LGUs. Increase in livelihood opportunities.	• Design and implement a robust "local first" hiring policy of q ualified applicants. • Observe no preference in terms of gender and race during the hiring process. • Source out other necessary consumable materials such as food from the community, people's organization, and/or farmers. • Provide livelihood trainings, as part of the SDP, to project-affected communities	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
			in preparation to the forthcoming opportunities.			
	Quality of Life: Transportation Network	Traffic Congestion	Prevent possible traffic congestion by implementing the following: • Plan logistic movement of equipment to avoid high density traffic areas and use of alternate routes; • Schedule hauling and movement of construction vehicles by avoiding peak hour traffic such as 11 PM to 5 AM (from Manila) and to 8 PM to 6 AM (from Bataan) • Assign traffic personnel to ensure normal flow of vehicles particularly at intersections; • Conduct detailed traffic survey/route alignment to determine optimum route and schedule.	Project proponent/ contractor	Part of construction cost	Proponent and Contractor's MOA
II. Operational Phase						
Sewage and wastewater generation from various sources, including storm water and run-off from land	**The Water**					
	Plankton community	Will eventually end up in the nearshore marine waters of Lucanin (through the Amo River and Lucanin River)	Will develop the necessary infrastructure in the area of sewage and wastewater management to make the proposed broiler farm project sustainable.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
		Water pollution with nitrate and pathogenic phosphate (usually fecal germs and Salmonella) is the main cause for concern in the case of poultry farming. Marine plankton communities can be negatively affected by the presence of these pollutants. Phytoplankton red tide organisms or HABs require nitrogen and phosphorus for their rapid growth, or bloom	Liquid wastes should be directed to a planned water treatment plant facility to ensure that coastal waters will be free from biological and bacteriological contaminants (liquid waste must be treated before it is released into the environment to prevent any harm or risk it may have on the environment and human health). Appropriate treatment will be employed so that the final effluent would meet the DENR water quality standards. Plankton monitoring/examination should be directed at screening for the occurrence of phytoplankton "red tide" organisms or other harmful algal bloom species.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Surface and groundwater Quality	Degradation of water quality due to increased sewage, wastewater and solid waste from workers	Storm water should be diverted to the storm drains/canals (discharge points to be checked and inspected on a weekly basis for any sign of contamination before it will be discharged to the aquatic environment) • Implementing best management practices (BMPs) for nutrient and waste management, including proper storage and disposal of manure and other waste products. • Reducing the use of antibiotics and other chemicals that could potentially leach into surface water sources. • Regular monitoring of surface water quality to identify and address any potential issues in a timely manner.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
Clearing of vegetation and earth moving activities; change in land use	**The Land**					
	Terrestrial flora	Biodiversity decline (decrease in species richness and abundance)	• Off-setting of lost vegetation through rehabilitation of suitable planting areas with native vegetation species; • Regular monitoring of species composition in the baseline sites; inclusion of flora protection programs in the IEC of the proponent.	Multi-partite Monitoring Team (MMT) or other	Php 75,000/monitoring period	Included in the EMoP, ECC condition

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
				monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)		
Accumulation of fecal matter from the poultry farm that can contaminate the nearby habitats such as the river system	Terrestrial Fauna	• Water pollution to the nearby river system • Disease transmission such as parasites from fecal matters to wildlife animals • Ingestion of toxic materials from fecal matters	Provision and construction of Waste water handling and treatment facilities such as • Anaerobic Baffled Reactor with Constructed Wetland - domestic wastewater coming from sanitary facilities of integrated building of different farmhouses will be treated via series of baffles along the treatment chamber • Wastewater Lagoon - wastewater discharge from the seasonal cleaning of houses will be treated via series of lagoons : Facultative, Aerobic, Maturation Pond and Engineered Wetlands • Sewage Treatment Plant - domestic wastewater from the ancillary building will be treated in a STP	Proponent and outsourced Terrestrial Fauna expert)	Php 100,000	Included in the EMoP, ECC condition
Operations of the broiler farm	Soil	Soil Contamination	• Implementing proper waste management: Proper management of waste is crucial to prevent the accumulation of waste products that can lead to soil contamination. Best management practices (BMPs) for waste management may include proper storage and disposal of manure and other waste products, composting, and the use of waste management systems such as lagoons or anaerobic digesters. • Using chemical inputs responsibly: The use of chemicals such as antibiotics, disinfectants, and pesticides can potentially contaminate soil. To reduce the potential impact of these substances on soil quality, it is important to use them responsibly and in accordance with recommended application rates and practices. • Implementing soil conservation practices: Soil conservation practices such as cover cropping, conservation tillage, and crop rotation can help to improve soil quality, reduce erosion, and maintain soil health. • Regular soil testing and monitoring: Regular soil testing and monitoring can help to identify potential issues with soil quality and allow for timely interventions to prevent contamination or degradation. • Engaging in responsible land use practices: Responsible land use practices such as minimizing land disturbance, reducing runoff, and avoiding soil compaction can help to maintain soil structure and prevent soil degradation.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	The Air					
Poultry farm operation (manure management, dead chicken disposal, etc.)	Air Quality	Odor nuisance	• Ensure that mechanical interventions at all points of entry and adequate ventilation to keep manure dry. • Implement a proper waste management to minimize or avoid odor nuisance that will arise • Regular maintenance of ventilation fans and other equipment • Ensure regular Collection of manure and proper handling and treatment. Collection of manure should be within time interval of 24 hours Regular house keeping of facilities	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Noise	Increase in noise levels	• Install adequate or appropriate mufflers at tailpipes of mobile equipment and generator sets • Strictly impose speed limits on access roads and within the project area.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
	The People					
Operations of the broiler farm	Health and Safety	Risk on health and safety of the workers as well as the neighboring community	• Develop and implement an Environment ,Health and Safety Program • Establish and implement a solid waste management program • Close coordination with Barangay Local Government Units for any complaints (Complaints registry) • Residual wastes and hazardous wastes will be collected and transported to AFAB accredited landfill and/or treatment facilities by licensed waste transporters Implementation of safe work methods and practices Compliance to National Standards, local regulations and laws	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Multiplier effect and improvement of local /regional economy	Increase in employment opportunities and improvement quality of life	• Apply the "Local First" Hiring Policy for qualified personnel, wherever applicable • Observe no preference in terms of gender, religion and ethnicity during the hiring process • Source out other necessary consumable materials such as food from the community, people's organization, and/or farmers. • Provide livelihood trainings, as part of the SDP, to project-affected communities in preparation to the forthcoming opportunities.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
	Quality of Life: Transportation Network	Traffic Congestion	• Prevent possible traffic congestion by implementing the following: • Plan logistic movement of equipment to avoid high density traffic areas and use of alternate routes; • Schedule hauling and movement of trucks by avoiding peak hour traffic • Assign traffic personnel to ensure normal flow of vehicles particularly at intersections; • Conduct detailed traffic survey/route alignment to determine optimum route and schedule.	Proponent's Environmental Unit/Contractor	Part of Operation Cost	Included in the EMoP, ECC condition
III. Abandonment Phase						
Removal of broiler farm facilities	**The Water**					
	• Plankton and benthos communities and local fisheries	• No negative impacts are predicted	• No mitigation is needed			
	• Surface and groundwater Quality	• Degradation of water quality due to increased sewage, wastewater	• Proper waste disposal: Ensure that all waste generated during decommissioning is properly disposed of, including any sewage and solid waste. Follow local regulations and guidelines for waste disposal to prevent contamination of water sources. • Site cleanup: Conduct a thorough site cleanup after decommissioning, including removal of any remaining waste or debris. This will prevent any potential negative impacts on water quality and other environmental resources. • Restoration of the site: Restore the site to its natural state after decommissioning, including the removal of any buildings, structures, or equipment. This will minimize the impact on the surrounding environment and prevent any long-term negative impacts on water quality. • Water Quality monitoring: Monitor surface and groundwater quality around the site after decommissioning to ensure that there are no negative impacts on water quality. If any issues are identified, appropriate action should be taken to address	Proponent's Environmental Unit/Contractor	Part of Abandonement Cost	Included in the ECC condition

PROJECT PHASE / ENVIRONMENTAL ASPECT (PROJECT ACTIVITY WHICH WILL LIKELY IMPACT THE ENVIRONMENTAL COMPONENT)	ENVIRONMENTAL COMPONENT LIKELY TO BE AFFECTED	POTENTIAL IMPACT	OPTIONS FOR PREVENTION OR MITIGATION OR ENHANCEMENT	RESPONSIBLE ENTITY	COST	GUARANTEE / FINANCIAL ARRANGEMENTS
			them. • Community engagement: Engage with local communities and stakeholders during decommissioning to identify any concerns or issues related to water quality, and take these into consideration in the planning process.			
	LAND					
	Soil	Soil contamination	• Soil testing: Conduct soil testing before decommissioning to identify any potential contamination that may need to be addressed. If contamination is identified, appropriate measures should be taken to remediate the soil before decommissioning. • Proper waste disposal: Ensure that all waste generated during decommissioning is properly disposed of, including any soil that may be contaminated. Follow local regulations and guidelines for waste disposal to prevent contamination of soil and water sources. • Site cleanup: Conduct a thorough site cleanup after decommissioning, including removal of any contaminated soil. This will prevent any potential negative impacts on soil quality and other environmental resources. • Restoration of the site: Restore the site to its natural state after decommissioning, including the removal of any buildings, structures, or equipment. This will minimize the impact on the surrounding environment and prevent any long-term negative impacts on soil quality. • Monitoring: Monitor soil quality around the site after decommissioning to ensure that there are no negative impacts on soil quality. If any issues are identified, appropriate action should be taken to address them. • Community engagement: Engage with local communities and stakeholders during decommissioning to identify any concerns or issues related to soil quality, and take these into consideration in the planning process.	Proponent's Environmental Unit/Contractor	Part of Abandonement Cost	Included in the ECC condition

4 SOCIAL DEVELOPMENT PLANS (SDP) AND IEC FRAMEWORK

4.1 SOCIAL DEVELOPMENT PLAN (SDP)

The proposed Social Development Pan of Lucanin Multi-Tier Broiler Project is shown in **Table 4-1**.

Table 4-1 Proposed Social Development Plan

CONCERN	PROPOSED ACTIVITIES	TARGET BENEFICIARY	AGENCY PARTNERS	INDICATIVE TIMELINE	SOURCE OF FUND
Education	Participation/support in the Annual Brigada Eskwela event at Lucanin Elementary School by volunteer employees and contracted workers	Elementary Schools (s) in Brgys. Lucanin, Alion and Townsite Mariveles, Bataan	Department of Education	During Operational Phase	SMFI
Environment	Participation/support in the Tree Planting Program of the AFAB	Municipality of Mariveles	AFAB, Mariveles LGU, Brgys. Lucanin, Alion and Townsite	During Operational Phase	SMFI
	Participation/support in the Adopt-a-River Program of AFAB, if any	Lucanin River Amo River	Area Free Port of Bataan (AFAB)	During Operational Phase	SMFI
	Participation/support in the International Coastal Clean-up (the world's biggest volunteer effort to protect the ocean) by employees and contracted workers of SMFI every September	Municipality of Mariveles	Area Free Port of Bataan (AFAB)	During Operational Phase	SMFI
Health and Nutrition	Supplemental Feeding Program	Daycare Center(s) in Brgys. Lucanin, Alion and Townsite, Mariveles, Bataan	Municipal Welfare and Development Office, Municipal Health Office, Barangay Health Station	During Operational Phase	SMFI
	Blood Letting Program – Eligible employees and contracted workers will participate in this program that will be initiated by the Proponent. A bag of blood can potentially save three lives.	Mariveles LGU, Brgys. Lucanin, Alion and Townsite	Philippine Red Cross, Municipal Health Office, Barangay Health Station	During Operational Phase	SMFI

4.2 INFORMATION, EDUCATION AND COMMUNICATION (IEC) PLAN

The proposed Information, Education and Communication plan is shown in **Table 4-2**.

Table 4-2 Information, Education and Communication Plan

PARTICULARS	ACTIVITIES
For the Muniipality of Mariveles	Courtesy Call/ Information Education Campaign
For Barangays Alion, Lucanin and Townsite	Information Education Campaign Barangay Forums/ Consultation Perception Survey

5 ENVIRONMENTAL COMPLIANCE MONITORING (ECM)

5.1 RATIONALE

Environmental Monitoring (EM) shall be performed to determine the impacts of the project in all phases of its implementation and to provide an early warning tool for detecting any contamination and pollution that may arise. EM shall serve as basis for the efficient of the mitigating measures. It shall be continuous, periodic and shall involve field observations, samplings and analysis. It is essential to detect and correct violations, provide evidence to support the mitigating actions, and evaluate enforcement by succeeding monitoring activities.

Monitoring shall be undertaken to determine the effects against the baseline data gathered. This shall be done to ensure that all mitigating measures are religiously implemented and that negative impacts beyond tolerable levels are carrying capacity are detected and mitigating measures shall be implemented before it aggravates. It makes economic sense to correct environmental degradation during the early stages than introducing corrective measures, when the problem becomes almost irreversible and the financial costs are very high.

5.2 SELF-MONITORING PLAN

Monitoring of certain parameters during both the construction and operation phase of Lucanin Multi-Tier Broiler Project is essential to ensure that impacts are fully evaluated and that necessary mitigation measures are applied. This is necessary to demonstrate compliance with any current and future standards. Based on the identified impacts, an environmental monitoring plan (EMoP) was prepared. This is to ensure the environmental soundness of the project implementation. **Table 5-1** summarizes the propose monitoring plan and includes the key environmental components (land, water, air and people) categorized per project phase along with its corresponding potential impacts to which AFAB Rules and Regulations may be applied.

A Compliance Monitoring Report (CMR) will be prepared by the proponent using the guidelines stipulated in EMoP and the prescribed format in Annex 3-1 of DAO 2003-30

Table 5-1 Environmental Monitoring Plan (EMoP) for Lucanin Multi-Tier Broiler Project

MODULE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETERS TO BE MONITORED	SAMPLING AND MEASUREMENT			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME[2]					
								EQPL RANGE			MANAGEMENT MEASURE		
			METHODS	FREQUENCY	LOCATION			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
I. PRE- CONSTRUCTION PHASE													
Land	Terrestrial Flora	Biodiversity indices, species richness and abundance	Belt-transect method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Proponent and Outsourced Terrestrial Flora expert)	Php 100,000/sampling	-	-	-	-	-	-
	Terrestrial Fauna	Biodiversity indices, species richness and abundance	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Proponent and Outsourced Terrestrial Fauna expert)	Php 100,000/sampling	-	-	-	-	-	-
II. CONSTRUCTION PHASE													
Land	Terrestrial Flora	Biodiversity indices, species richness and abundance Occurrence and or counts of premium or native species	Belt-transect method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)	Php 75,000/monitoring period	10% decline in species composition with reference to baseline data or ranges can be identified by the MMT	30% decline in species composition with reference to baseline data or ranges can be identified by the MMT	50% decline in species composition with reference to baseline data or ranges can be identified by the MMT	Enhance maintenance and protection activities in the buffer zones	Rehabilitation of suitable planting areas with native tree species	Rehabilitation of suitable planting areas with native tree species with enhanced maintenance and protection activities to ensure higher plantation survival rate
	Terrestrial Fauna	Biodiversity indices, species richness and abundance; presence of absence of important native and endemic wildlife species	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	MMT; Environmental Officer; Outsourced Terrestrial Fauna expert	Php 100,000/sampling	10% decline in species composition with reference to baseline data	30% decline in species composition with reference to baseline data	50% decline in species composition with reference to baseline data	Continue monitoring; Determine the cause of decrease in species population	Continue monitoring; Determine the cause of decrease in species population; Coordinate with MMT	Continue monitoring; Determine the cause of decrease in species population; Coordinate with MMT; Determine

[2] *EQPL-Environmental Quality Performance Levels based on DAO 2003-30*

MODULE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETERS TO BE MONITORED	SAMPLING AND MEASUREMENT			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME[2]					
								EQPL RANGE			MANAGEMENT MEASURE		
			METHODS	FREQUENCY	LOCATION			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
													which parameters near the limit
Water	May tend to limit light penetration which is essential in photosynthesis/plank-ton production, and may lead to irritation and clogging of gills of pelagic fish larvae/juveniles due to siltation/sedimenta-tion and increased turbidity from land clearing and excavation	Plankton species composition, richness, abundance and biomass	Plankton net sampling	Semi-annual	Nearshore (closer to river mouths) and offshore	PCO/Environ-mental Officer	50,000	80-100% decline in baseline data on species composition, richness, abundance and biomass	30% decline in baseline data on species composition, richness , abundance and biomass	50% decline in baseline data on species composition, richness, abundance and biomass	Investigate whether the decline is project-related or non-project related	If project related then inform concerned department/pro-ject management. If not project related, then inform MMT, LGU and DENR	If project related, evaluate existing mitigation measures being implemented. Implement a more effective mitigation measure as necessary. If not project related, then inform MMT, LGU and DENR for proper action
	Water Quality	TSS	Grab Sampling	Monthly	Baseline Stations	Contractor	10,000/month	-	-	-	-	-	-
		pH, BOD, Temp, DO, chloride, fecal coliform, nitrate, phosphate, color, oil and grease	Grab Sampling	Quarterly	Baseline Stations	Contractor	100,000 per quarter	-	-	-	-	-	-
Air and Noise													
	Increase in fugitive/ dust and gaseous emission	Ambient TSP, PM_{10}, SO_2, and NO_2	TSP– High volume-Gravimetric, USEPA 40 CFR, Part 50 PM_{10}- High volume with 10 micron particle-size inlet-Gravimetric, USEPA 40 CFR, Part 50, Appendix J SO_2 – Gas Bubbler - Pararosaniline Method	Quarterly or as frequent as necessary	Project boundary and nearest residences	Project proponent/ contractor	PhP 50,000 per month	≥75% of ambient standard. EQPL (Alert Mininum in μg/Nm^3) NO_2 = 195 TSP = 225 PM_{10} = 150 SO_2 =255	≥ 90% of ambient standard. EQPL (Action minimum in μg/Nm^3) NO_2 = 234 TSP = 270 PM_{10} = 180 SO_2 =306	NAAQS (in μg/Nm^3) NO_2 = 260 TSP = 300 PM_{10} = 200 SO_2=340	Monitor levels and determine prevailing wind flows and other meteorological condition Identify possible sources of high ambient concentrations	Check for complaints from residence Implement mitigation measures to reduce fugitive emissions during construction (e.g., water spraying) Inform management in case the proposed project is the possible source of high	Suspend construction related work that causes exceedance with ambient levels (e.g., TSP) and implement corrective measure (e.g., water spraying)

Module	Potential Impacts per Environmental Sector	Parameters to be Monitored	Sampling and Measurement			Lead Person	Annual Estimated Cost	EQPL Management Scheme[2]					
								EQPL Range			Management Measure		
			Methods	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
			NO_2- Gas Bubbler-Griess Saltzman Method or Chemiluminescence Method									ambient levels based on meteorological condition	
	Increase in noise levels	Noise Levels	Direct reading/sound level meter	Quarterly (or as frequent as necessary) (depends if there are complaints from nearby residents)	Residences and other noise sensitive receptors adjacent construction sites	Proponent	Included in air monitoring	Post-ECC agreement	Post-ECC agreement	NPCC (1980) ambient noise standard: a) Class A- Residential - Daytime= 55 dBA -Evening/ morning = 50 dBA -Nighttime =45 dBA	Check background noise levels	Check sources of noise that contribute to higher noise levels	Implement noise attenuation measures
		Vehicles, machineries	Operates equipment, machines according to manufacturer's instruction. Limit operations of loud equipment during daytime (as much as it is practical) Regular inspection and maintenance of equipment machineries Provision and use of appropriate PPE Review complaint register	Monthly	Number and details of noise complaints	Proponent	Included in air monitoring	-	-	-	-	-	-
People	Employment opportunities	No. of locally- hired worker during construction stage (skilled and unskilled);	Actual count/ interview	Monthly	Project Site	Contractor's Safety Officer	-	-	-	-	-	-	-
	Hazard to Workers	Implementation of safe work methods and	Observation/	Daily	Project Site	Contractor's	300,000	-	-	-	-	--	-

MODULE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETERS TO BE MONITORED	SAMPLING AND MEASUREMENT			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME[2]					
								EQPL RANGE			MANAGEMENT MEASURE		
			METHODS	FREQUENCY	LOCATION			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		practices	occurrence			Safety Officer							
	Health and safety of workers	Implementation of COVID-19 safety protocol	Actual count of active cases	Weekly	Project Site	Contractor's Health and Safety Officer	300,000	-	-	-	-	-	-
III. OPERATION PHASE													
Land	Terrestrial Flora	Biodiversity indices, species richness and abundance Occurrence and or counts of premium or native species	Belt-transect method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	Multi-partite Monitoring Team (MMT) or other monitoring agency (if applicable); Environmental Officer; Outsourced Terrestrial Flora expert)	Php 75,000/monitoring period	10% decline in species composition with reference to previous monitoring data or ranges can be identified by the MMT	30% decline in species composition with reference to previous monitoring data or ranges can be identified by the MMT	50% decline in species composition with reference to previous monitoring data or ranges can be identified by the MMT	Enhance maintenance and protection activities in the buffer zones	Rehabilitation of suitable planting areas with native tree species	Rehabilitation of suitable planting areas with native tree species with enhanced maintenance and protection activities to ensure higher plantation survival rate
		Growth Performance and Survival Rate of planted native tree species	Height and diameter measurement; counting of survived planted seedlings	Semi-annual	Suitable planting/rehabilitation areas	Environmental Officer; Outsourced Terrestrial Flora expert	Php 100,000. (*varies depending on the hectarage and type of planted species*)	>90% survival rate	85-90% survival rate	<85% survival rate	Continue the implementation and establishment of rehabilitation areas	Enhance maintenance and protection activities	Replanting with appropriate native tree species
	Terrestrial Fauna	Biodiversity indices, species richness and abundance; presence of absence of important native and endemic wildlife species	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	Semi-annual	Baseline sampling stations	MMT; Environmental Officer; Outsourced Terrestrial Fauna expert	Line-transect method, mist-netting method, opportunistic sampling and ethnobiological surveys	10% decline in species composition with reference to baseline data	30% decline in species composition with reference to baseline data	50% decline in species composition with reference to baseline data	Continue monitoring; Determine the cause of decrease in species population	Continue monitoring; Determine the cause of decrease in species population; Coordinate with MMT	Continue monitoring; Determine the cause of decrease in species population; Coordinate with MMT; Determine which parameters near the limit
Air	Odor nuisance	Odor	Complaints registry – number and details of odor and other	Every 2 weeks	Nearby residents	PCO	Part of PCO task	-	-	-	-	-	-

MODULE	POTENTIAL IMPACTS PER ENVIRONMENTAL SECTOR	PARAMETERS TO BE MONITORED	SAMPLING AND MEASUREMENT			LEAD PERSON	ANNUAL ESTIMATED COST	EQPL MANAGEMENT SCHEME[2]					
								EQPL RANGE			MANAGEMENT MEASURE		
			METHODS	FREQUENCY	LOCATION			ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
			complaints										
People	Employment opportunities	No. of locally- hired worker during construction stage (skilled and unskilled);	Actual count/ interview	Monthly	Project Site	SMFI's Safety Officer	-	-	-	-	-	-	-
	Hazard to Workers	Implementation of safe work methods and practices	Observation/ occurrence	Daily	Project Site	SMFI's Safety Officer	300,000	-	-	-	-	-	-
	Health and safety of workers	Implementation of COVID-19 safety protocol	Actual count of active cases	Weekly	Project Site	SMFI's Safety Officer	300,000	-	-	-	-	-	-
Water	Proliferation of harmful algal species or phytoplankton toxic "red tide" due to nutrient (nitrogen and phosphorous) enrichment of coastal waters	Species composition and abundance of phytoplankton "red tide" organisms or harmful algal blooms (HABs)	Phytoplankton net sampling and microscopic examination of causative dinoflagellate organisms	Semi-annual	Nearshore (closer to river mouths) and offshore	PCO/Environ-mental Officer	50,000	70-100% proliferation of phytoplankton dinoflagellate species causing red tide in the plankton samples	40% proliferation of phytoplankton dinoflagellate species causing red tide in the plankton samples	10% proliferation of phytoplankton dinoflagellate species causing red tide in the plankton samples	Investigate whether the prolifera-tion is project-related or non-project related. If "red tide" occurrence is not project related, then immediate-ly inform MMT, LGU/BFAR and DENR for p0roper action	If project related then inform concerned department/pro-ject management. If not project related, then immediately inform MMT, LGU/BFAR and DENR	If project related, evaluate existing mitigation measures being implemented. Implement a more effective mitigation measure as necessary. If not project related, then inform MMT, LGU, BFAR and DENR for proper action
	Water Quality	TSS	Grab Sampling	Monthly	Baseline Stations	Contractor	10,000 / month	-	-	-	-	-	-
	Water Quality	pH, BOD, Temp, DO, chloride, fecal coliform, nitrate, phosphate, color, oil and grease	Grab Sampling	Quarterly	Baseline Stations	Contractor	100,000 per quarter	-	-	-	-	-	-

6 EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

Emergencies are unforeseen events or episodes that are caused by natural forces and circumstances that may result to negative effects to people, property, and the surrounding environment. As a preliminary step in developing an effective emergency response policy, it is important to identify the potential emergency scenarios that would most likely occur.

Emergency situations may also require different levels of classification and response procedures, depending on the degree of situations. These levels will be referred to as: 1) Incident; 2) Emergency; and 3) Crisis.

Incident situations present minor events that may require partial or total mobilization of the proposed Project's resources to effectively deal with an accident. An episode may present very minimal injuries and/or partial damages to property.

Emergency situations require the utilization of all resources, with the assistance of local emergency responders, and additional resources from SMFI main office. This episode may present serious injuries and some fatalities and could result to severe or total damage to the property.

Crisis situations are the worst conditions, which require the utilization of full resources, and possibly, assistance from the national government to address the event. An episode may present multiple fatalities, destruction of facilities, and severe/total damage to the surrounding community.

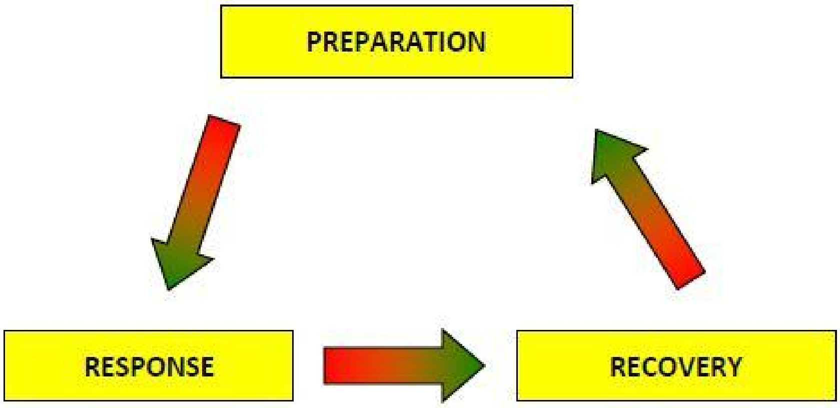
6.1 EMERGENCY PLAN

The Emergency Plan is a management structure that is intended as a guide for the personnel during emergency situations. This structure may or may not be similar to the existing organizational/management hierarchy of the Project, although comparison on roles and responsibilities can be used as reference.

The implementation of the Emergency Plan is a standard practice that is currently being integrated as part of company policies. Its objective is to establish an orderly and systematic approach in addressing an emergency, and in turn, decrease further injuries/fatalities and loss of property.

Forming the Emergency Plan requires the Proponent to select among the different skills and knowledge of its personnel at the Project. The selection process will involve background checks, training and skills learning, and voluntary application of selected personnel. The proposed project will follow the schematic diagram and procedures presented in **Figure 6-1** and **Table 6-1.**The roles and responsibilities of each personnel involved in the Emergency Plan are listed in **Table 6-2.**

The designation of the personnel and their corresponding responsibilities may be changed during different types of emergency scenarios that were previously identified in this section. Therefore, if such case will exist, SMFI will train and designate personnel appropriately to deal with each type of emergency.



- **PREPARATION** - development of actual plans should an emergency happen and elimination or avoidance of hazards from happening or occurring
- **RESPONSE** - execution of the plans and procedures during an actual emergency plan
- **RECOVERY** - retrieval of important assets and restoration of the site prior to the emergency

Figure 6-1 Emergency Response Plan

Table 6-1 Emergency Response Procedures for Different Scenarios

PREPARATION	RESPONSES	RECOVERY
A. Fire		
• Orientation and training of personnel on fire safety. • Conduct of annual fire drills. • Installation and quarterly/annual testing of firefighting devices (i.e., fire hoses, fire extinguishers, smoke detectors, sprinkler system)	Notice personnel to keep calm and later to prevent further injuries to follow further emergency evacuation procedures and to report immediately any presence of smoke, spark or open flame to authorized personnel.	• Prohibition of returning to the fire scene, as long as necessary, unless declared for safe entry. • Checking for personnel that may be trapped, injured, or needs further assistance. • Reporting of nay important incident that require immediate attention
• Inspection of electrical equipment and lines for any defect or malfunction, and replacement, as necessary. • Securing of all flammable items in prescribed containers and storage facilities • Strict implementation of “No Smoking” policy in plant facilities • Placement of emergency numbers and communication equipment in conspicuous areas for easier notification • Designation of emergency exits (free from obstruction) and evacuation procedures • Maintenance of plant equipment	• Immediate use of fire extinguishers, only if the fire can still be contained. • Disconnection of electrical or fuel connections and shutdown of all affected equipment • Removal of all flammable material from the fire scene to avoid further contact, if possible • Wearing prescribed fire protection attire (i.e., fire suit, boots, breathing apparatus) by responders • Prohibition of using or pouring of water over fuel or alcohol fires, and electrical fires.	Securing of important items and equipment from unauthorized access from outsiders, after the building is declared safe fro re-entry. If fire damage is minimal, or if facility is recoverable, implementation of necessary corrective measures to prevent the accident from re-occurring.

PREPARATION	RESPONSES	RECOVERY
B. EARTHQUAKE		
• Conduct of necessary preparation, including equipment and facility checks, to prevent injuries in an event of an earthquake. • Securing of all loose items to prevent falling • Placement of heavy materials near the ground • Storage of flammable items in designated safe areas • Orientation of personnel on safe locations, emergency response equipment, and evacuation routes.	Notice personnel to keep calm and alert to prevent further injuries to protect themselves by getting under sturdy structures and stay aat from sharp , flammable, or heavy items and to prepare for immediate evacuation of the facility, if necessary shutdown of all gas and electric equipment.	• If there are no threats of aftershocks, checking for personnel that may be trapped, injured, or need further assistance. • Prohibition of returning to the facility if it is deemed structurally unstable or declared unsafe. • Thorough inspection of the facility premises for any unusual crack, gap in the ground walls. • Checking for possible fires and advise authorities for appropriate response. • Securing of important items and equipment from unauthorized access from outsiders, after the building is declared safe for re-entry. • Inspection of the facility for any major structural defect, crack, unstable item, and other potential hazards. • If earthquake damage is minimal or facility is recoverable, implementation of corrective measures to prevent the further hazards from affecting personnel and property.
C. OCCUPATIONAL HAZARDS		
• Provision of basic PPE • Formation of an emergency response team for each department • Provision of first-aid kits and emergency equipment on critical workstations • Training of personnel on proper equipment handling and other safety practices	• Immediate reporting of any accident, especially those considered life-threatening. • Immediate application of first aid • Removal of affected personnel from the accident site • Bringing of affected personnel to the nearest first aid station or hospital if necessary.	• Performing of corrective measures on equipment and procedures. • Provision of additional safety procedures, equipment, and training.
• Posting of safety reminders on workstations. • Provision of safety features, such as adequate lighting, guide rails, and safety signage.		

Table 6-2 Roles and Responsibilities in the Emergency Plan

EMERGENCY RESPONSE PERSONNEL	ROLES AND RESPONSIBILITIES

EMERGENCY RESPONSE PERSONNEL	ROLES AND RESPONSIBILITIES
Incident Commander	Overall in-charge of operations during an event of an emergency
Safety Officer	Supervises the daily safety performance of operations and maintenance procedure, including emergency response procedures.
Liaison Officer	Secures the necessary permits and training certification for the personnel
Public Information Officer	Performs communication duties on behalf of SMFI to the media, government officials, and the local population. Issues relevant warnings and advisories to concerned authorities
Operations Team	Performs the actual response, rescue, and retrieval of personnel and equipment during an event of an emergency
Planning/Intelligence Team	Devices program and policies for prescribed response procedures. Inform the operations team regarding the nature and type of response procedure for the Operations Team Identifies potential hazards and performs recommendations to authorities
Logistics Team	Provides the necessary supplies and equipment for the Operations Team Provides additional support/assistance to the Operations Team
Finance and Administration Team	Provides the assessment of expenses and allocates the necessary financial resources for the other Teams. Performs the disbursement of claims and compensation for affected personnel, property, an the community

6.2 SAFETY AND HEALTH PROGRAM

SMFI gives priority to the safety of its employees and their working environment. It developed this program for accident and injury prevention through the implementation of plant rules and guidelines that shall involve management, supervisors, and employees in identifying and eliminating hazards that may develop during the work process.

6.3 LEADERSHIP AND MANAGEMENT

The management will spearhead in the formation of a safety committee, develop a system for identifying/correcting hazards, prepare for foreseeable emergencies, provide appropriate trainings, and establish a disciplinary policy to ensure strict compliance.

- ***Company Safety Policy*** – it is the basic policy that no task is so important that an employee must take risk of injury/illness or violate a safety rule. Active involvement in safety practices is then encouraged to make the area a safe place to work.

It is the daily duty of every employee to be cautious of unsafe con. In addition to this, supervisors or accountable managers are responsible in overseeing the actions of employees and to take prompt action in eliminating unsafe practices and hazards in the workplace.

6.4 ACCIDENT/INCIDENT INVESTIGATION REPORTING

It is very advantageous for every employee to be prepared for any emergency to prevent further injury, property damage, and loss of limb or even life. An emergency preparedness plan must then be prepared and strictly implemented.

6.4.1 Accident/Incident Investigation Reporting

Prevention of accidents by eliminating potential threats/hazards and anticipating other probable causes is an effective way of creating a safe and healthy environment.

6.4.1.1 *Emergency Response Program*

The emergency response program shall be implemented by an emergency response team composed of equipped and trained personnel who will be tasked to handle and manage the program, assist other employees ro safety, and to prevent any damage or injury. Training and orientation of concerned team members by government-accredited/certified training institute/service provider will be accorded to prepare them in responding appropriately in any emergency they may encounter.

6.4.1.2 Personal Protective Equipment (PPE)

The emergency response program shall be implemented by an emergency response team composed This refers to a set of safety gear worn by personnel that is designed to provide sufficient safeguard against occupational related illnesses and to prevent life-threatening injuries. Wearing and usae of PPe (i.e., safety hats, safety shoes, gloves, dust mask, ear plugs) will be mandatory for both personnel and visitors entering the project premises..

6.4.2 Incident Response Procedure

Any accident, injury work-related illness should be reported and investigated immediately to determine the appropriate action to be conducted.

6.4.2.1 Recording and Review

It is mandatory that employees are to report any injury or work-related illness to their immediate supervisor regardless of how serious. Minor injuries, such as cuts as scrapes, can be entered on the first aid only log. More serious injuries are to be reported and recorded properly for future review.

6.4.2.2 Incident Investigation

It is imperative that an incident scene should not be disturbed except to aid in rescue or make the scene from further incidence. In case of an incident resulting in death or serious injuries, a preliminary investigation will be conducted by the immediate supervisor of the injures person(s), a person designated by management, an employee representative of the safety committees, and any other person whose expertise would help the investigation. The investigating team will obtain written statements from witnesses, photograph the incident scene and machines/equipment involved. The said team will also document, as soon as possible after the incident, the condition of equipment and anything that may be relevant in the work area. A written "Incident Investigation Report" is necessary. The report should include a sequence of events leading up to the incident, conclusions derived from the incident and any recommendation to prevent a similar incident in the future.

6.4.2.3 Damage Control

Damage cost because of accident, in reality, is unquantifiable, especially when damage to life and lomb is involved. Cost of properties structure, and equipment including its effect on existing productivity is quantifiable. Any employee may be subject to on-the-spot termination when a safety violation places the employee or co-workers at risk of permanent disability or death.

6.5 BUSINESS CONTINUITY PLAN

The purpose of this Business Continuity Plan (BCP) is to define the processes and approach used by SMFI to preserve business functionality in the event of significant disruption to normal operation caused by factors beyond our control (i.e. natural disasters, man-made events, tight supply situations, product contaminations, etc), and to restore services to the widest extent possible in a minimum time frame. All SMFI operations sites are expected to implement preventive measures whenever possible to minimize operational disruptions and to recover as rapidly as possible when an incident occurs.

Equally important with employing disaster preparedness measures is the sustenance of a strong relationship with the neighboring communities which can be achieved thru the conduct of timely, essential, and genuine Corporate Social Responsibility activities and by involving them on emergency response and other safety related trainings. The community can aid in securing the facility and clearing the road network during disasters.

The general objective of this plan is to sustain critical operations and to effectively:

- Provide a continuous supply of products to all customers.
- Maintain plant integrity or capability to receive, store and deliver products to customers; and
- Minimize disruption to supply chain.

7 ABANDONMENT / DECOMMISSIONING/ REHABILITATION POLICY

7.1 ABANDONMENT PLAN / REHABILITATION POLICY

San Miguel Food Incorporated (SMFI) will allocate sufficient time and available resources if the decommissioning, abandonment, and/or rehabilitation of the Project will be necessary.

Depending on the nature and reasons for abandonment, some facilities may not be necessarily demolished or removed from the site, since some of these can be useful for other applications. Otherwise, dismantling, removal, and transportation of the structures, equipment, and machineries from the existing site will be conducted to minimize possible or further threats to the surrounding environment.

Other activities that will be done during this Phase are:

- Compensation to all affected personnel in accordance with the Labor Code of the Philippines;
- Securing of necessary government clearances related to the abandonment of the existing Project (including request for the relief of ECC conditions and commitment);
- Removal of solid, liquid, and hazardous wastes within the site throughAFAB -certified waste transporter/treater; and
- Clean-up and possible remediation of the site, if future evaluations and testing suggest that such activity is applicable.

8 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

8.1 Institutional Plan

The organization is formed to achieve the following:

- Economical and safety operations and maintenance of the proposed Project components;
- Implementation of the company policies;
- Environmental compliance and sustainability; and
- Promotion and enhancement of the social acceptability of the proposed project

The institutional organization will involve SMFI's top-level management, who is responsible for providing the corporate direction and policies of the company. The policies shall then be disseminated to the department heads and managers for implementation of the company personnel, including those who will be working on the operations of the proposed project. **Figure 8-1** shows the organization chart for the institutional plan.

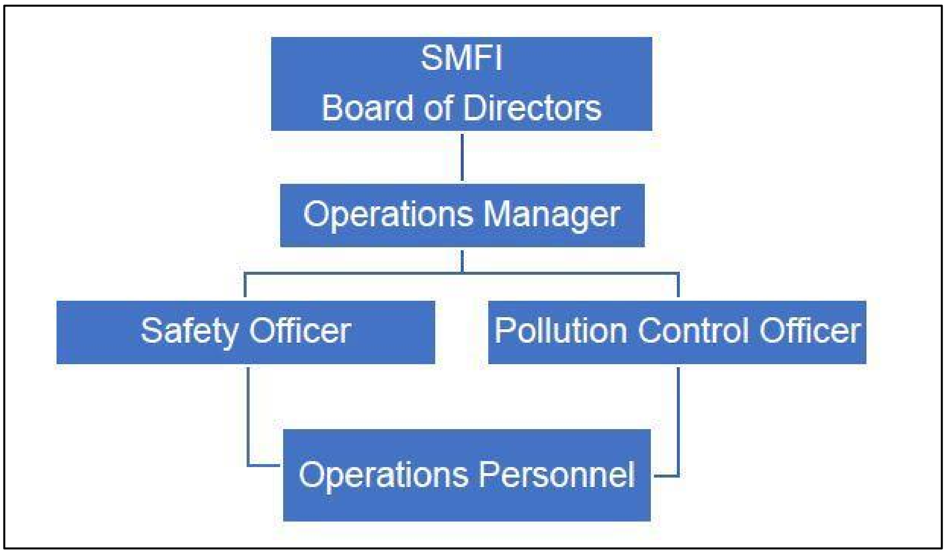


Figure 8-1 Organization Chart for the Institutional Plan

SMFI will also establish a partnership with relevant government agencies, various stakeholders, and local host communities in relation to the project. This partnership is necessary to maintain a transparent and positive relationship for the proposed project and its stakeholders, as well as to ensure that the environmental protection and enhancement measures are complied with.

The key stakeholders of the proposed project will be identified as the following:

- Municipality of Mariveles;

- Barangays Lucanin, Alion and Townsite;
- Residents and community organizations that will be affected by the proposed project;
- Various industry organizations;
- Local peace-and-order councils (i.e., PNP, Barangay Police); and
- Other concerned non-government organizations.

San Miguel Food Incorporate (SMFI) commits to:

- Comply with the commitments and conditions that will be stipulated in the EIS, ECC, and other related environmental laws;
- Foster mutually beneficial partnership and cooperation with the host community;
- Promote sustainable use and responsible development of resources by adopting appropriate technologies;
- Develop livelihood programs and upgrade skills of host community to contribute and enhance the quality of life; and
- Develop training programs for its employees to ensure that they will be continually prepared for the tasks assigned to them.
- Develop and implement a grievance redress mechanism to be handled by an environmental, health, and safety officer.

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